Telephone Engineer

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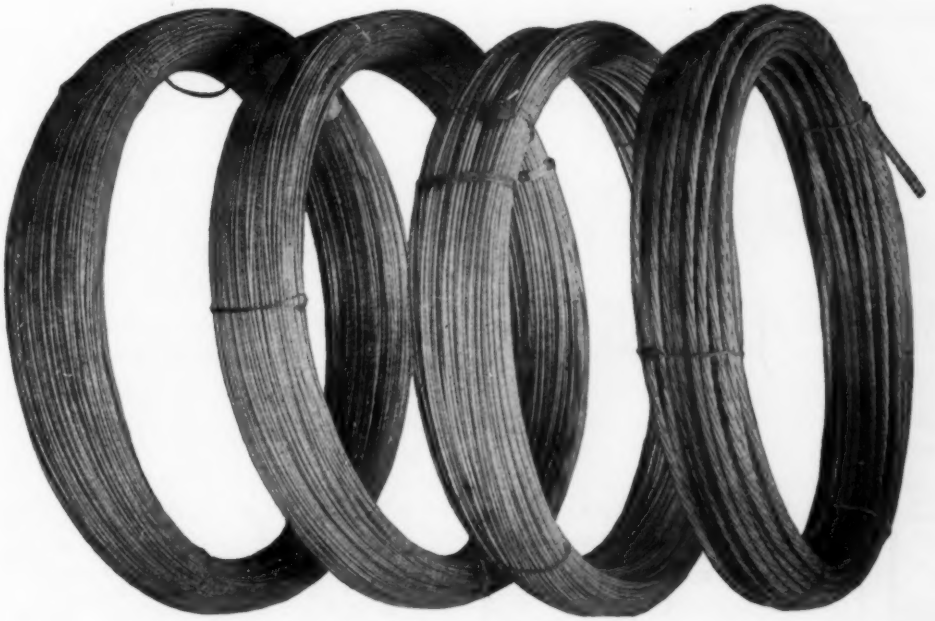

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TELEPHONE ENGINEER

236 N. Clark St., Chicago. Telephone, STAte 3161

No. 6 Published Monthly by 1928
Vol. 32 J. A. SMITH June

SUBSCRIPTIONS:—The subscription price of TELEPHONE ENGINEER is $2.00 a year in the United States, Cuba and Mexico; in Canada it is $3; in all other countries $4. Single copies, U. S. A., 20 cents.

Entered as second-class matter, June 6, 1922, at the post office at Chicago, Ill., under the act of March 3, 1879.

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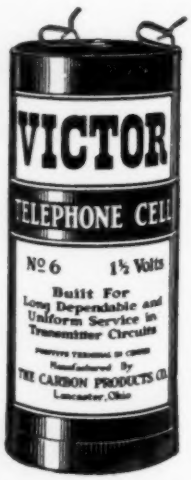

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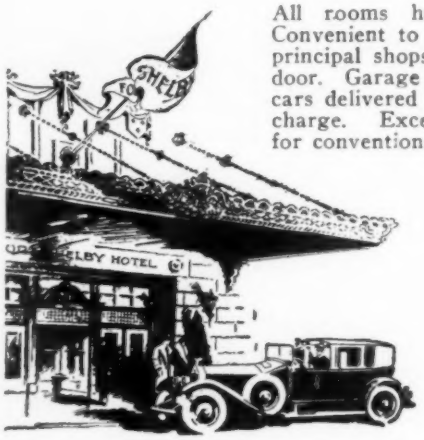

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Brochure on Request

Telephone Engineer

Volume 32 JUNE, 1928 No. 6

Radio Not a Competitor of the Telephone

A few years ago when radio communication first came to public attention through the broadcasting of programs, there were many people who believed that we were at the beginning of a new era in which radio would supplant wire communication. Some investors in securities of wire companies were disturbed by the fear that now prosperous companies might follow the way of canal companies after the coming of railroads. Better informed people, knowing the limitations in number of radio channels and the difficulties of attaining even a moderate degree of secrecy of voice communication by radio, nevertheless saw in radio the possibility of private communication channels which would avoid the payment of tolls to the wire companies.

The congestion in radio broadcasting channels that soon became apparent, culminating in federal legislation and the recent order of the Federal Radio Commission requiring some 170 stations to suspend operations, has dispelled any fear that radio will supersede wire for ordinary land communications, but there are evidently many concerns who still have the idea of private communications systems. The demand for channels when short wave bands were opened up is evidence of this and the federal commission found it impossible to satisfy all applicants in spite of the relatively large number of channels available in the short wave bands. Many of these applications were from concerns that handle no public traffic and others were for point-to-point communication on land.

Radio as a means of communication is particularly suited to situations where one or both stations are in motion, as for instance on ships, aircraft, and moving trains. Its next most important use is to reach remote places beyond the reach of wire communication. At present, this applies to telephone communication overseas at distances beyond practicable limits of cable lines. Radio broadcasting is also of great importance as no wire system would seem to be capable to such wide distribution of intelligence. Least in importance from a public standpoint is communication along channels where wire communications exist or are economically feasible.

The demand for transoceanic telephone communication is increasing and we are told that it is now necessary at times to delay messages across the Atlantic. More channels must be made available either through the development of more highly directive systems of non-interfering type or by the abandonment of some of the telegraph channels in favor of telephone by diverting the traffic to ocean cables. The tendency toward consolidation of international radio and cable companies should make the working out of these problems more simple when the need becomes acute. In the meantime, the assignment of channels to private concerns and for point-to-point communication where wire lines are available, should be made with such restrictions as are necessary to permit the later use of these channels in the more important services from the standpoint of general public benefit.

Keeping Roadsides Clean

At the Indiana Convention, in the course of his paper on "Co-operation between State Highway Commission and Wire Using Companies," Mr. A. H. Hinkle, Superintendent of Maintenance of the State Highway Commission of Indiana read some letters from district superintendents giving their ideas of the way in which highway authorities and wire using companies might make easier the difficult problems arising out of highway improvements. A notable thing was the fairness with which these men stated the shortcomings of their own forces and the candor with which they gave the complaints that they have to make relative to the work of the wire companies.

One particular cause of complaint on the part of the highway maintenance forces that can be corrected with only a little care by wire using companies is the littering of the road sides with the debris of old lines that have been dismantled. Old poles, cross arms, bundles of wire and other litter are left in the ditches and along the fences. Poles are chopped off some distance above the ground line

and the stump is left in place as an obstruction to the flow of water, to grading and to mowing of weeds.

It should be a matter of pride with telephone companies to contribute to the appearance of the highways by removing all of their old material, brush from tree trimming and other debris from the roadsides and thus contribute their share to the maintenance of well kept road sides.

A. T. & T. Favors Its Stockholders

Following the policy repeatedly enunciated by President Gifford and other officials, the American Telephone and Telegraph Co. has offered to its stockholders the right to subscribe to new stock at par in the ratio of one new share for every six shares held. This right, which is computed to have a value of about $12 per share, constitutes a handsome "extra" to the several hundred thousand stockholders of the company.

Although opposed to extra dividends and stock splitups, the management of the Bell System has held consistently to the idea that the stockholders are entitled to a reasonably high dividend rate and the right to obtain additional stock on favorable terms whenever expansion of the company requires new financing. As a result of this policy it has built up the largest list of stockholders of any modern corporation and the number is still growing.

One of the results of this system is that the company has been enabled to do its financing almost without the aid of bankers and its management has been able to follow its own policies without being checked by those who are interested primarily in the way the stock will act on the market. With an enlightened management in a position to operate the property in the interest of the service and of the stockholders, the company is in an enviable situation as far as its financial affairs are concerned. It does not need "melons" of a type other than it has been offering to induce the investment of new capital adequate for its needs.

Home Town Pride—and Its Possibilities

"You will be glad you came to R————," says a sign erected by a service club at the limits of a certain progressive small city. Just another piece of community boosting, of course, but back of it may be seen the desire to please the visitor and the feeling of pride in the town.

It is a natural thing for a resident of any community to desire to be proud of his home town. He likes to think of its people as being the best on earth and he takes pride in its advantages over other towns. He boasts of its fine churches, its modern schools, its progressive stores and its busy factories. To him it is the "best little old place in the world."

He is just as anxious to be proud of his local telephone system as he is of other institutions. He would like to think that its plant is just a little more modern, its operators just a little more courteous and its services just a little more prompt than that in any other place.

If he does not feel and talk this way about his telephone system, both the community and the telephone system have lost something. Too often he does not feel and talk so because his attention has never been called to the facts.

He does not know that the switchboard is the last word in modern equipment. He never thinks of the thousands of wires in the underground cables away from storm and fire. He has no mental picture of the net work of copper wires connecting his town to the rest of the world.

He ought to be given the opportunity to know the real excellence of his telephone service. Telephone companies should spend more time in telling of the improvements they are making and less in apologizing for occasional lapses in service.

Home town papers are glad to publish stories of these improvements. Home town residents are glad to read about them. When telephone service is added to the list of things about which a community boasts, the residents, the town and the telephone company all profit.

The Lost Time Problem

The problem of reduction to a minimum of lost time of construction, installation and maintenance forces is one that is always with us. A certain amount of lost time will always be unavoidable but the lost time which does not show on time reports is even more serious than that which is reported. Many a job is charged with time that is never actually spent in performance of work but is lost in waiting for more adequate directions on work orders, delays and waits to secure materials and a variety of other causes. The gang that reports in the morning knowing just where it is to work for the day, just what is to be done and that tools and materials will be available when needed will be the one that shows a minimum of lost time on its reports and probably will be found to rank well up when performance ratings are made. The problem is one of proper advance planning and adequate supervision as well as of gang performance. Many times a poor performance rating is chargeable against the supervisory forces or warehouse and garage departments instead of against the gang itself.

Loading Combined Telegraph and Telephone Circuits

By F. J. DOMMERQUE*

(Continued from last month.)

Filters separate the carrier current telephone or telegraph channels from each other or also the carrier frequencies as a group from the frequencies used for ordinary telephone and telegraph work. The filter shown in Fig. 5 on the left consists of two parts, the one part, just mentioned, which passes frequencies below 3,000 cycles per second but blocks out those above 3,000 cycles, and the other part combined with it, which passes all frequencies above 3,000 cycles and blocks out those below 3,000. In accordance with these functions the two associated filter parts have received the name "low pass" filter for the part which passes the frequencies below 3,000 cycles, that is, frequencies used in the regular telephone and telegraph circuits, and "high pass" filter for the other part. In Fig. 7 is outlined how the inductance coils and condensers are arranged in this filter combination.

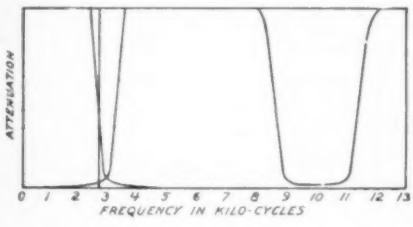


Fig. 5 Filters

In Fig. 5 on the left an attenuation curve of a real filter is shown, which crosses the cut-off frequency line at about 2,800 cycles, the same cut-off frequency line as in the figure of the February TELEPHONE ENGINEER. The new curve extends further to the right than the loading curve, because it forms part of a "carrier" filter. A carrier current is an alternating current of a frequency higher than the highest frequency represented in the message to which it corresponds, in the telephone message higher than 2,200. The carrier current obtains its name from its destination, namely from being superimposed by a telephone or telegraph current, which it is to carry. It is made to vary in accordance with these telephone or telegraph currents, and serves principally for transmission of from 2 to 5 telephone messages and a still greater number of telegraph messages over one and the same circuit. In Fig. 6 a carrier current is shown, the first half as the plain carrier and the second half superimposed by a telephone talking current. Carrier currents will be discussed in another article.

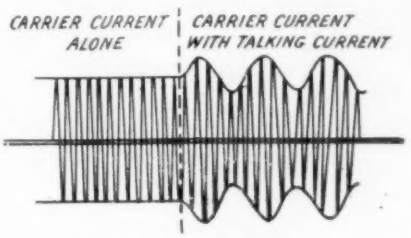


Fig. 6. Carrier Current

The filter located at the right-hand side of Fig. 5 is a carrier current filter to transmit a "band" of frequencies, whence its name "band-pass" filter. It transmits one of two bands, either the upper side band of a carrier of 9,000 cycles per second or the lower side band of a carrier of 11,000 cycles per second, as the case may be. There are in every combination of carrier and talking current curve two frequency bands, one of which extends from the carrier frequency plus 200 upwards to the carrier frequency plus 2,000, and the other from the carrier frequency minus 200 down to the carrier frequency minus 2,000. These bands have been appropriately termed the "upper" and the "lower side bands," respectively. The composition of a band-pass filter is illustrated in Fig. 8.

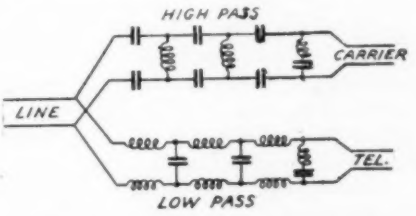


Fig. 7. Carrier Filter Combination

From Figs. 7 and 8 it will be seen that a filter is composed of a number of sections; this number depends entirely on the degree to which it is desired to extinguish the currents to be filtered out. If the number of sections is doubled, the ratio of the current of any particular frequency entering the filter to the current of that frequency leaving the filter is approximately squared. There is in existence quite a variety of filters, we have given only two of the most characteristic ones.

Another kind of networks has obtained the name "balancing" network, on account of its use to balance telephone lines. Frequently those balancing networks are designated artificial lines. Artificial lines have been known for many years in transmission tests, but the artificial lines used as balancing networks are of a different type, they are much simpler. Their principal purpose consists in simulating very closely over the wide range of telephone frequencies the impedance of the actual line. An absolutely perfect balance is practically unattainable, but it is possible to obtain a balance, which makes "singing," that is, the production of a strong, steady tone rendering conversation impossible, practically unnoticeable. It must not be lost sight of that we are speaking here of the application of balancing networks in long repeatered lines. The network does not need to have transmission characteristics corresponding to those of the line to be simulated, but it must have substantially the same impedance characteristics.

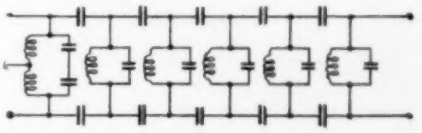


Fig. 8. Band-Pass Filter

With the repeatered lines appeared also more severe demands on balancing of the lines. As an example we refer back to the October, 1927, number of TELEPHONE ENGINEER, page 33, where in Fig. 98 a 22 type repeater circuit was outlined. From the brief description of this circuit and also from the words said about the prevention of unbalancing in toll cables inserted on the same page, it becomes apparent that the operation of repeaters depends greatly on the condition of the line. Irregularities may be caused by small variations in the spacing of loading coils and also by variations in loading coil inductance; by insufficient or irregular transpositions; by non-uniformity in the construction of the line, etc. All these irregularities must be corrected before a line can be properly balanced.

A long aerial wire non-loaded line can be easily simulated by a simple network consisting of a resistance R and a condenser C connected in series, such as illustrated in Fig. 9; but there is hardly a case of open long distance line where not a piece of cable has to be inserted at one

*Journal A. I. E. E., Feb., 1921.

place or other. Then the difficulties commence. The best way out would be to insert a network representing the open wire past from the start up to the cable and in series with it a network representing the cable part, following it with a network simulating the other line part.

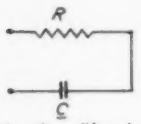


Fig. 9. Simple Net Work

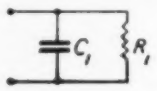


Fig. 10

Still greater difficulties are experienced when the lines are loaded. Not only the line itself must be balanced in the network, but also the loading coils and any other device inserted in the line. However, there is a simple network arrangement which will balance a loaded line including the devices connected to it, namely a resistance R_1 and a capacity C_1 connected in parallel as shown in Fig. 10. Should the line be phantomed the network would have to consist of two sections as indicated in Fig. 11. These two impedance networks are, however, only applicable with a certain reservation which will be explained presently.

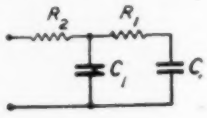


Fig. 11

First, we will give some general information on the impedance of loaded lines. We have learned that the impedance of a non-loaded, that is, of a uniform line having distributed inductance, is $Z = \sqrt{\frac{L}{C}}$. A loaded line can be compared theoretically with a uniform or homogeneous line having an equal total inductance, an equal total resistance and the other electrical constants equal; but a loaded line has in addition a cut-off frequency $f_c = \frac{\omega_c}{2\pi} = \frac{1}{\pi s \sqrt{LC}}$, where S designates the loading coil spacing, that is, the distance between two consecutive loading coils, and L and C the inductance and capacity in reference to unit length of line.

Below the cut-off frequency the expression of the impedance of a loaded line becomes rather complicated. For this reason a set of curves is inserted which shows the impedance in its relation to the frequency. The impedance has two components, designated at an earlier occasion as actual resistance and blind resistance. These two components may also be called "resistance" component and "reactance" component. Fig. 12 shows the values of both these components in respect to their frequency relation. The

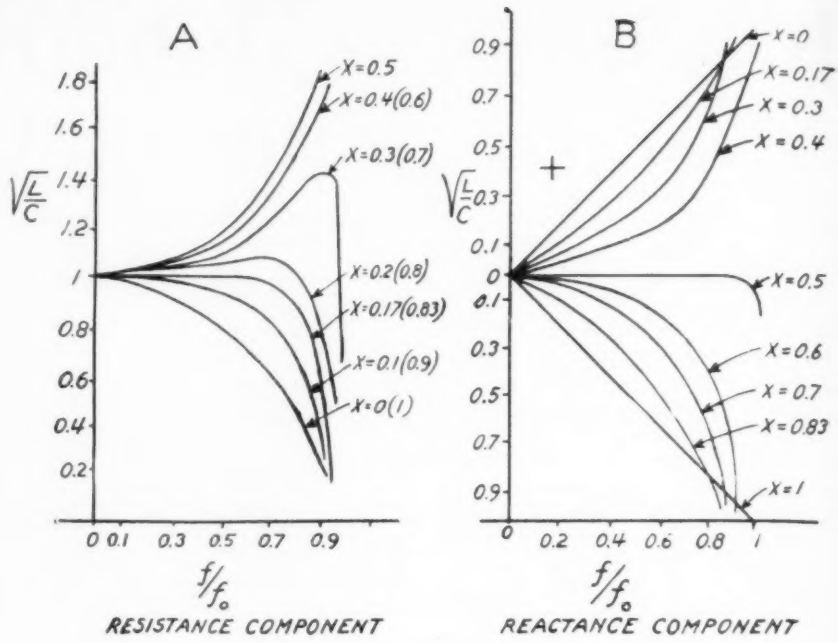


Fig. 12. Impedance of Loaded Line

scale of abscissae gives the frequencies; however, they are not noted direct, but as fractions of the cut-off frequency, the numerator "f" denoting the operating frequency and the denominator "f_c" the cut-off frequency. The ordinates have as units the values of $\sqrt{\frac{L}{C}}$. The curves "x" indicate the fractional length of the leading-up section of the loaded line; that is, the ratio of the line part before the first loading coil to the length of a full loading section. "x" also represents the ratio of the capacity of the leading-up section to the capacity of the full section. Now, the values of both the impedance components depend upon the length of the leading-up section and upon the frequency. As already stated in a previous article, if the leading-up section is one-half of the complete section, the resistance component increases with increasing values of frequency in approaching the cut-off frequency, while the reactance component remains negligible over the entire frequency range as can be plainly seen in Fig. 12 by examining the curves for $x = 0.5$.

The curves $x = 0.17$ and $x = 0.83$ show that the resistance component remains constant nearly up to the cut-off frequency, while the reactance component increases with increasing frequency, the reactance component for $x = 0.17$ being inductive and for $x = 0.83$ capacitive.

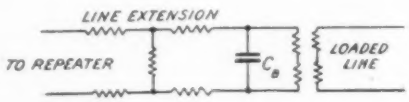


Fig. 13

The actual loaded line impedances, however, do not give such smooth curves as shown in Fig. 12, which are theoretical curves. In practice the curves are wavy, they show more or less distinct variations which render an efficient balancing very difficult. Therefore some means must be found to smooth out the actual impedance variations. As an acceptable degree of smoothness can be considered, when the inductance and capacitiy of loading coils and cables does not vary more than 2 per cent to 3 per cent. To obtain this end, the last or terminal section of the loaded line to be balanced can be extended by an attenuation network consisting of resistances as shown in Fig. 13, and a bridged condenser C_b. It appears that with a leading-up or terminal section of 0.17 of a full loading section or 0.83 of a full section the best results would be obtained; therefore the simple balancing network shown in Figs. 10 and 11 will only then be satisfactory when the bridged condenser C_b supplements the line to at least 0.83 of the full loading section. This is the reservation mentioned above.

Telephone Company Reports Year's Gain

The Southern California Telephone Company in its annual report to the State Railroad Commission shows a gross corporate income for 1927 of $5,727,472.59 as opposed to $5,092,428.76 for 1926. This represents the amount available for interest, amortization of debt discount, other fixed charges, non-operating expenses, dividends and surplus.

The net operating revenue for 1927 is reported at $21,110,390.28 as opposed to $18,917,911.60 for 1926.

Studying Telephone Methods

E. R. COLLINS

Manitoba Telephone System, Brandon, Man.

CHAPTER 17

Checking Switchboard for Noisy Circuits

Every telephone exchange has to a certain degree certain lines which are designated as noisy. It is quite often true that such lines are allowed to remain Noisy and defective until the subscriber makes a serious complaint. This should not be allowed, as the telephone company should at all times endeavor to maintain its lines in as nearly a perfect condition as possible.

Suppose some evening when you have a little spare time on your hands, you take an ordinary telephone receiver, and fit it with a plug and cord. Then sit down nice and comfortable at the switchboard, and go over every line on the board. Mark down carefully in numerical order any lines that seem at all noisy.

You might do this and not detect any lines that are very bad. If so, try an ordinary operator's set plugged into the position, and the transmitter battery cut off, and test all the lines as shown in Fig. 137. A quiet long distance, or toll line, is connected with a regular switchboard cord circuit, to all the local lines on the switchboard, and then note down the results. There will be some lines which when connected to the long distance line will make it noisy. This noise may be due to a poor connection, on the local line, a ground on the local line or a cross with some other line. Make a careful record of all the lines which cause noise on the toll line and then we will proceed to clear them one at a time.

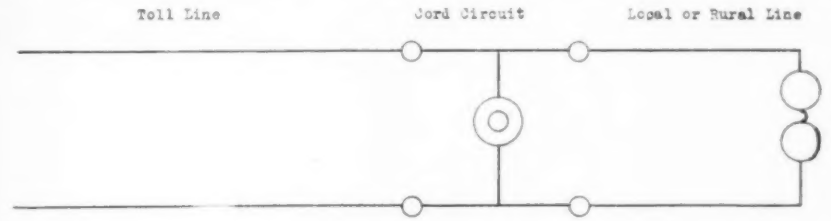


Fig. 137

Checking Local or Rural line for Balance using a Toll Line for Test.

If your exchange has a regular test desk, with a voltmeter and set of testing keys, then you will naturally test these noisy lines for ground or cross. However, many exchanges do not have a regular test equipment, and some scheme must be used to take the place of the test desk.

A Weston model 280 volt ammeter is a very convenient type of instrument to have, as it can be used for so many purposes. A cheaper type such as the Pignolet or Jewell will give very good results. For testing battery use a 22½ or 45-volt radio "B" battery. It will be compact and will last a long time for this purpose.

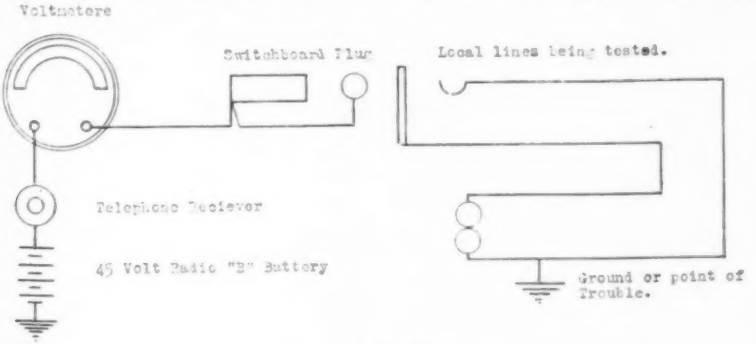


Fig. 138

Method of making quick check for Grounds on Telephone Circuits.

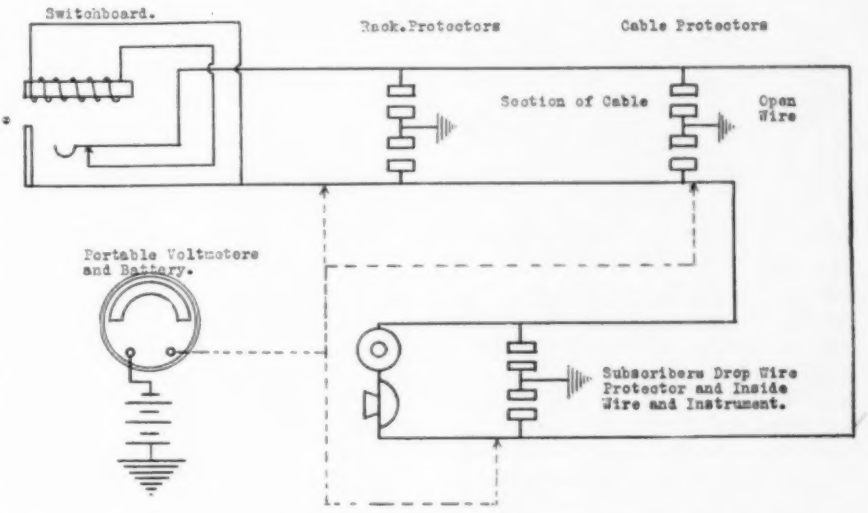


Fig. 139

Checking the Line with Voltmeter

Connect the voltmeter and battery in series with an operator's telephone receiver. Connect one side to ground, and the other side of the circuit to the switch board plug, as shown in Fig. 138. In case there is danger of the 45 volts damaging the meter, on a low resistance grounded line, connect an additional resistance, of 200 or 400 ohms in series with the receiver and the voltmeter. You can now proceed to check over the lines on the board for grounds. The telephone receiver will give a warning click when a line in trouble is being tested, and then you can read the meter to get the amount of the ground reading. These readings need only be marked down for comparison. The use of the receiver will relieve your eyes from the strain of watching the meter too closely, and yet will prevent you from missing any lines which have a ground reading.

Locating the Ground on Lines Tested

The next step is to find where the ground or loose connection is, so that the trouble may be cleared.

In Fig. 139 is shown a schematic drawing of the probable places for a ground to occur. Where carbon block arresters are used, grounds are likely to occur due to lightning or other high voltage current discharges. First pull out the heat coils and test the line from the board again. If the trouble is outside, then you

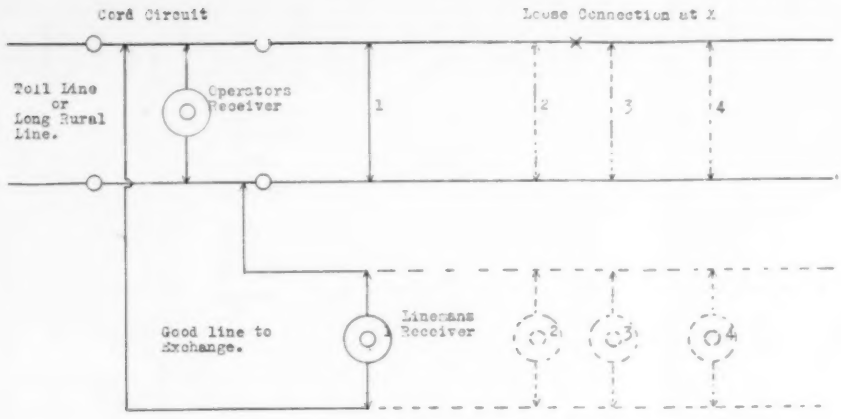


Fig. 140
Method of locating bad joint in Telephone Circuit.

will not get the voltmeter reading you had when making the first test. In making tests on metallic circuits, it is a good practice to always open both sides of the line. That is, you would pull out both heat coils at the rack, and not one. You would remove both fuses at the cable box and not only one. Opening a line at a branch such as at "A," Fig. 141, you would take off both the line wires going to subscriber No. 3 instead on just the one. This is a mistake so often made by troublemen, and the man at the test desk will give an incorrect test at times if both sides of the line are not opened.

Portable Voltmeter Test Set

A very compact portable test set can be assembled by using a Pignolet or Jewell voltmeter, with a 22 or 45 volt battery and two resistance coils as shown in Fig. 143. The shunt coil across the voltmeter is to give the meter a lower reading so that smaller variations in resistance can be measured. The series coil will have to be adjusted so that the voltmeter and shunt will not draw too much current on a low resistance circuit. The whole assembly can be fitted into a leather carrying case with a shoulder strap, and can be carried along to the point where a test is to be made. This will be valuable where there is no one at the exchange to test with. Some operators might be trained to do this testing for you, but operators are changing so often that the trouble man might get a bum steer frequently. In Fig. 139 the dotted lines show the portable voltmeter connection. This is used to test at different points as the line is opened at the rack, the cable box and at the subscriber's drop wire. Now here is the most important point to remember. When you have located the cause of the trouble make a permanent repair. If the cable pair is grounded, change the pair. If there are no spares, and the whole cable is wet, then get a cableman and have it repaired. Methods of locating cable trouble will be dealt with elsewhere. If the open wire is cut into trees, get permission to trim the trees and *trim* them. If the drop wire is worn, put up a new one, and if the inside wire is damp, rewire the premises. Inside wire often causes trouble where the wires come up through the floors. A new wire pulled through the same hole will no doubt cause the same trouble again. Make a larger hole, and get a piece of circular loom. Pull the wire up through the loom, and have the loom project at least 6 inches above the floor. But whatever you do, make a permanent repair, so that you will be sure the trouble will not occur again for a long time at least.

Locating Loose Connections

Locating a loose connection requires a little different method of procedure. A line that is causing noise due to a loose connection can be cleared temporarily by ringing on it. For this reason, as soon as a line shows in trouble due to a loose connection, pull the heat coils out of the rack, or instruct the operators to avoid ringing on the line. If there is not much noise on the line, connect the line in trouble with a toll line or another long rural line. Then proceed to the cable box. Put a short circuit on the line, preferably on the open wire about a foot from the insulators. You will then have the short ahead of the cable fuses, and jumper. Now if there is a spare good line to the exchange, get the operator to open the key on the cord circuit, which connects the toll line and the line in trouble, so that you can listen to the noise as well as the operator. Then when you put the short on at position "1," Fig. 140, the noise will disappear if the trouble is ahead of you as shown at "X" in Fig. 140. When the short is taken off the noise will reappear. If the trouble had been between the short and the exchange,

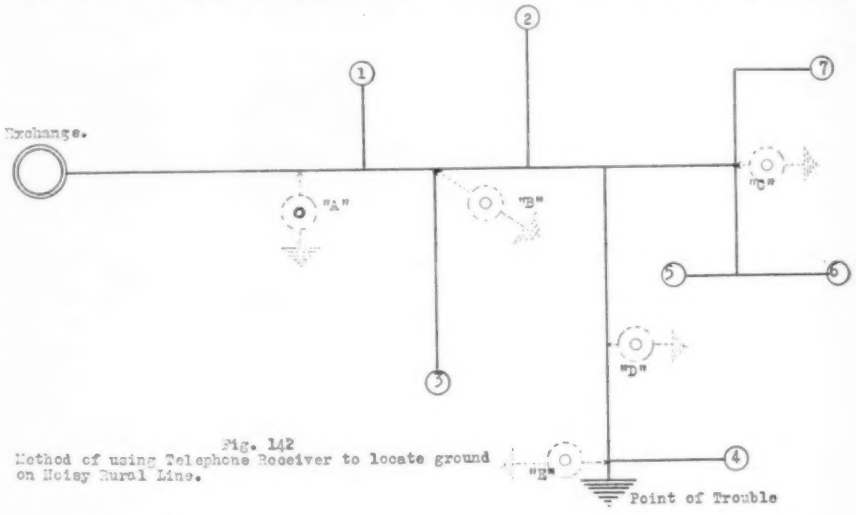
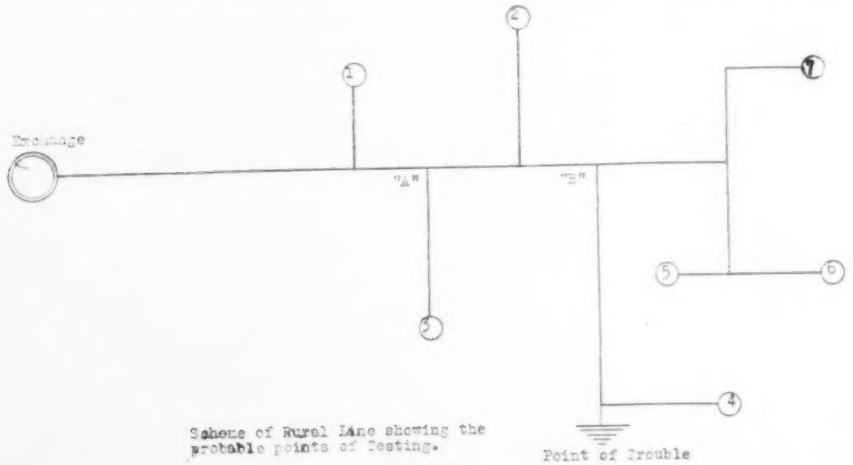


Fig. 142
Method of using Telephone Receiver to locate ground on Noisy Rural Line.



Scheme of Rural Line showing the probable points of Testing.

Fig. 141

the noise would not have lessened very much.

Unless there is a spare line following the line in trouble, it will be best to have the operator stay on the noisy line, and wait for you to speak to her. Then when you put the short on as at position "2,"

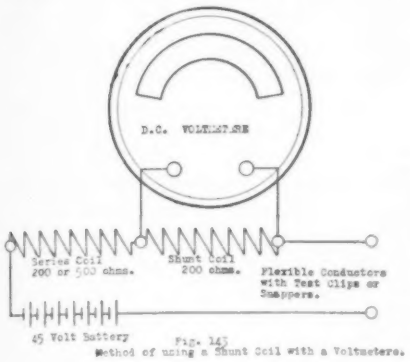

D.C. VOLTMETER
Series Coil 200 or 500 ohms.
Shunt Coil 200 ohms.
Flexible Conductors with Test Clips or Snappers.
45 Volt Battery

Fig. 143
Method of using a Shunt Coil with a Voltmeters.

Fig. 140, the operator will listen for you. If the line becomes quiet with the short on the trouble is still farther away from the exchange. Leave the short on for about a minute, then take it off and get the operator's report on the noise.

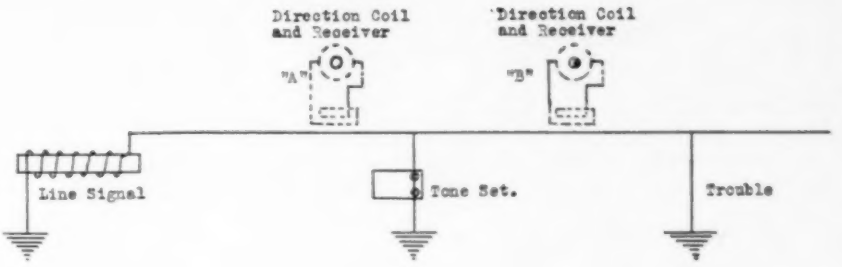


Fig. 146

Method of determining the direction of trouble.

office the noise will disappear when the short is put on. Thus by testing from point to point the location of the trouble can be cornered.

Iron wire joints unless soldered, or made with a standard steel twisted sleeve, will frequently develop very high resistances. One very bad joint the writer remembers measured over 400 ohms. Copper wire soldered to iron wire is often apparently well soldered. Testing will show, however, that a very high resistance joint is present. A good twist and the copper will turn around on the iron wire.

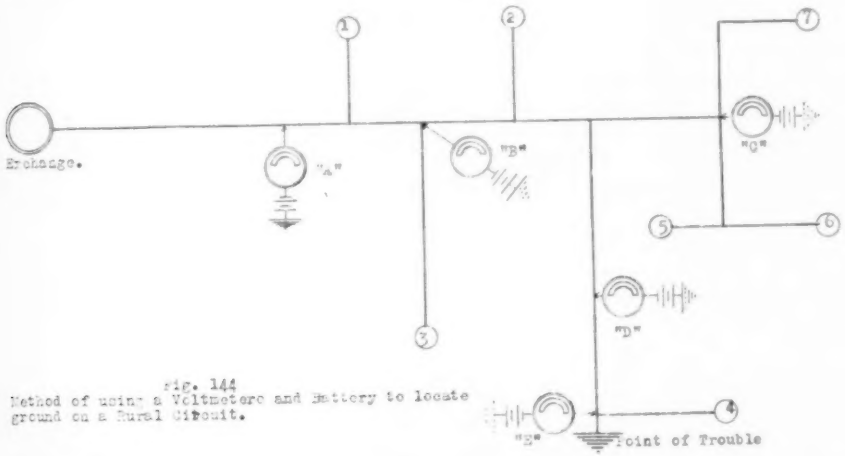


Fig. 144
Method of using a Voltmeters and Battery to locate ground on a Rural Circuit.

Next suppose you have gone to position "4," Fig. 140, and put on the short, the line will still be noisy. At position "3" it will still be noisy. When the post "X" is passed on the way back to the

It is much more satisfactory to locate a trouble by testing, even if it means more work, than would have been required to hunt for the trouble.

Loose connections can be located with the Wheatstone bridge, but we will discuss that at another place.

Locating Grounds on Rural Lines

Locating grounds on rural lines will consume a great deal of time and consequent expense for wages and livery hire. Any method that will cut down the waste of time, without mutilating the line, is to be desired.

In Fig. 141 is illustrated a rural line with 7 stations of subscribers. Long legs leave the main line at "A" and "B," as well as the short subscriber loops. The trouble might be on any one of the branches of the line. In this case we assume it is at *point of trouble* near subscriber 4.

Now we might open the line at "A," and we could cut off the subscribers 1 and 2, and test the subscriber's loop for ground, using the portable voltmeter. Testing at point "B" would show the ground toward subscriber No. 4.

Every time we cut the line at these points, we break a soldered connection, or unfasten a test clamp, or else the connection was neither soldered or clamped. Test clamps are not satisfactory, as they cause too much trouble. There is nothing that will take the place of a soldered connection.

Locating Ground with Receiver

In Fig. 142 we show the same line, and the ground at the same place. We will assume that the line is quite noisy or will appear so when a receiver is connected from one side of the line to ground.

Testing at point "A" with the receiver will show quite a loud hum. At point "B" the noise will not be so loud. At point "C" the noise will become louder again. This would indicate that you have passed the source of trouble. So come back and suppose you test again at point "D." Here the noise will be much less. Then if you test at "E" the noise will have disappeared. The receiver will have a low resistance ground on either side of it, therefore there will be no current flow through the receiver. This method often means considerable driving, and the results will vary with the resistance of the trouble. With a ground such as a protector carbon, or a push button, the results are quite positive.

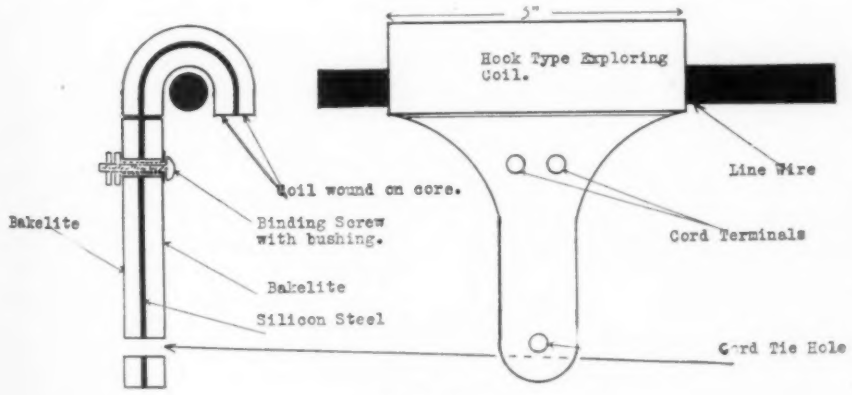


Fig. 145

Sectional view of Hook Type Exploring Coil for Direction Finder

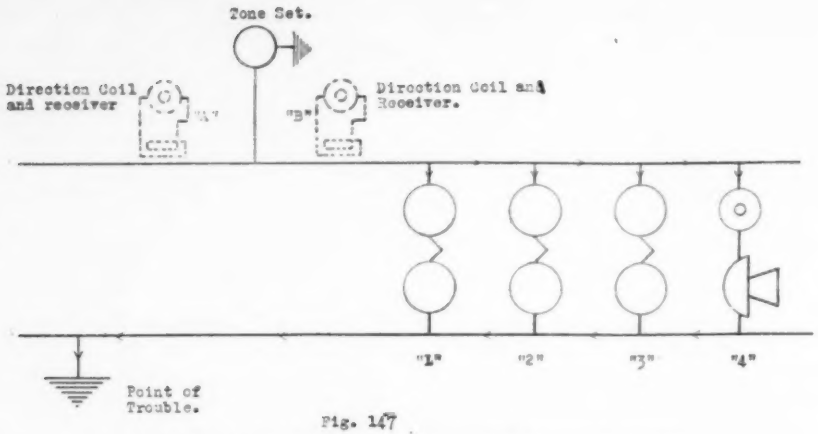


Fig. 147

Method of using Direction Finder to give incorrect results.

Locating Grounds with Voltmeter

The voltmeter and battery and coils shown in Fig. 143 are best enclosed in a leather carrying case. For locating grounds the voltmeter had best be equipped with a shunt coil. A coil of 200 ohms will give good results for the average voltmeter. Without the shunt, differences in resistance such as over a mile of No. 12 iron would not be noticed on the meters. With the shunt and voltmeter combined of a certain resistance, the actual value in ohms can be quickly computed.

In Fig. 144 the portable voltmeter set is shown in the dotted ground positions. With the ground still located at "E" we will take our first reading at "A." Assume the reading is 3. Then read again at "B" and assume the reading is 4. Reading again at "C" we find the reading has dropped back to almost 3 again. This would indicate that we were going away from the trouble again. So turning back we find our highest reading along the main line at the point where subscriber "4" joins the main line. We therefore turn down this branch of the line and test at "D." Here we find the reading is 5, and when we finally reach "E" the meter will read the full scale, showing that the trouble is very close to us. This method also means a lot of wasted time in driving.

Locating Grounds with Portable Tone Set

In Chapter 14, March issue, we discussed quite fully the use of tone sets and locator coils. In Fig. 110 we described a small hook shaped locator coil, which we used for direction finding.

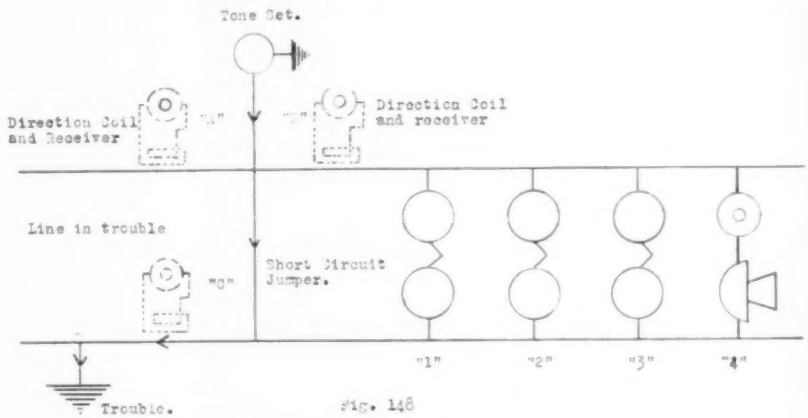


Fig. 148

Correct method to use Direction Finder Coil to Locate direction of ground on one side of the line.

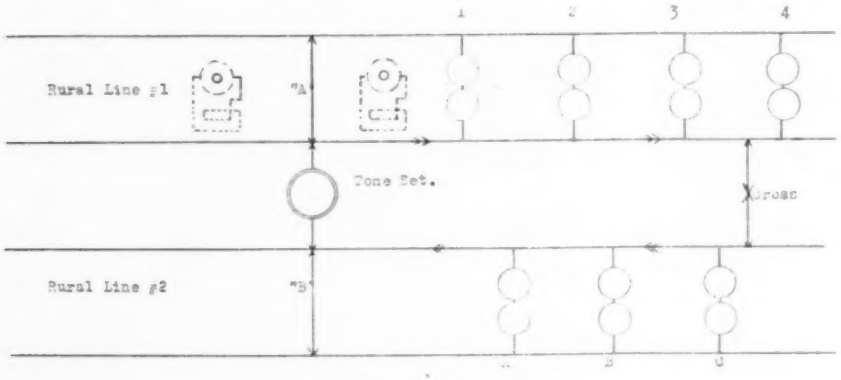
In Fig. 145 we show a coil quite similar but of larger dimensions. The total length of the coil running parallel to the line wire should be at least 3 inches to give comfortable results. As the conditions under which this will be used will be harder, the coil had better be covered with friction tape, in addition to the celluloid, and the tape painted with asphaltum varnish. The coil can be wound with 600 turns of No. 30 double silk covered copper wire.

In Fig. 146 we show one wire of a rural line grounded at point marked trouble. Now if we connect the tone set as shown, and hook the direction finder coil over the line wire, we will likely hear the tone both ways, but louder one way than the other. There will be some of the tone flow back through the drop coil to ground. We could cut the drop clear of the line before we leave the exchange, but that means that when the trouble is cleared we will not be able to get the operator for a final test.

The frequency of the tone from an ordinary buzzer will not be very high, possibly around 100 cycles per second. But we can increase the frequency if we use a radio test buzzer such as the radio amateur uses for his practice set. These will set up a tone around 800 cycles. Now the resistance of the line signal will be much higher for this high frequency, therefore very little tone will go back to the office. The difference then between the flow to the office and the trouble will be much greater, therefore the direction finder results will be more positive.

Testing for Ground on Metallic Line

In Fig. 147 is shown a condition that would give a false direction test. Suppose the trouble is on the lower side of the line, and the testing is done on the upper side of the line. The current flow will be in the direction of the arrows. This is through the ringer coils at 1-2-3 and the talking circuit of subscriber 4. We have assumed that subscriber 4 has come on the line to listen to funny noise. So the direction coil would indicate the trouble to be toward the subscribers, as shown by the arrows. But the trouble is actually in the opposite direction as the arrows would indicate. If the trouble man had taken the precaution to find out which side of the line gave the highest voltmeter reading to ground, then he would have noticed the mistake.



Method of using Direction Finder to locate direction of cross on two rural lines.

Fig. 149

In Fig. 148 we show the same arrangement, only the trouble man has short-circuited the line at the point where he is testing. Now the tone will flow across the short circuit, back over the line to ground at trouble. Now the only place the tone will be heard will be back toward the office as indicated by the arrow. Placing the short circuit across the line therefore when testing for a ground is the simpliest way to overcome this difficulty.

Now referring back to Fig. 141 and 142, if we were to use the direction finder when we reached the point of the

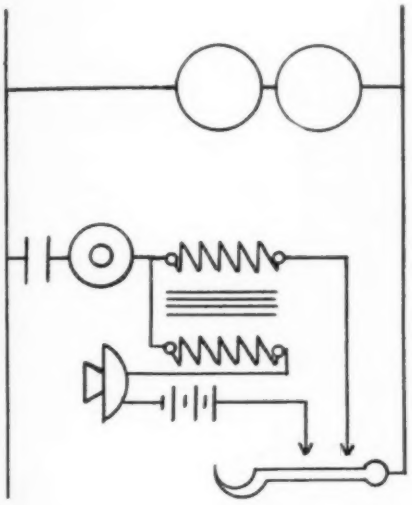


Fig. 150

Schematic Circuit of Magneto Rural Telephone with Condenser in Receiver Circuit.

line where the loop to subscriber "4" leaves the main line, we would find that the tone would be heard on the loop of subscriber "4" and not towards 5, 6 or 7 subscribers. Without further waste of time, therefore, you would proceed toward subscriber "4" and the trouble would be cleared very quickly.

Locating a Cross Between Rural Lines

In Fig. 149 is shown two rural lines crossed. If the tone set were connected as in Fig. 149, there will be 4 combinations that might be made before the two actual wires crossed can be located with the voltmeter and then the difference in reading might be very slight. A short circuit at "A" and "B" will overcome this uncertainty. Then there will be only one direction where the tone will show and that will be towards the trouble. This is indicated by the double arrows. It will be very convenient if a pair of jumpers with snappers are made up at the exchange and provided for this purpose, instead of depending on the use of connectors or making up jumper wires on the job.

Locating a short circuit presents no difficulty in using the direction finder. A direction finder set can be made up to use for this work, or a manufactured set can be purchased. The cost of such a set will be wiped out in a few weeks at the outside, by the time and expense saved. Service can be restored much more quickly by the use of this simple device.

There are two direction finder test sets on the market. One is made by Stewart Bros. of Ottawa, Ill., and the other is The West test set, distributed by the American Electric Co. of Chicago, Ill. Both these concerns will send a set on approval to responsible concerns. Your company should at least be satisfied that such a set will do the trick.

Condensers in Rural Sets

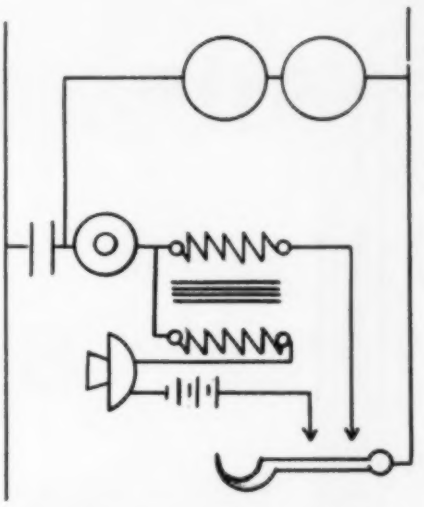
A short circuit on a rural line might occur at a distant point among the subscribers, such as subscriber 7, Fig. 141. The total joint resistance of the ringers across the line might be so low that a short circuit at subscriber 7 would make scarcely any difference to the reading of the voltmeter at the exchange.

In Fig. 150 is shown a typical arrangement of the ringers and the talking circuit of a rural set. The ½ M. F. condenser in series with the receiver offers a higher resistance to the talking circuit so that the bells will not be prevented from ringing, if the receiver is left off the hook.

Where it is desired to arrange the line, so that voltmeter readings will not show the loop of the ringer coils, the ordinary rural set can be changed as shown in Fig. 151.

Here the ringer wire is transferred from the line wire to the condenser. The effect of this will be that should the receiver be left off at one telephone, the bell at that telephone will not ring very well. But the effect on the bells of the other telephones will not be changed. Some ringers may have to be adjusted a little, but the general ringing effect will be about the same.

The effect of this change will be as shown on Fig. 152. It will be noticed that if a voltmeter and battery were con-



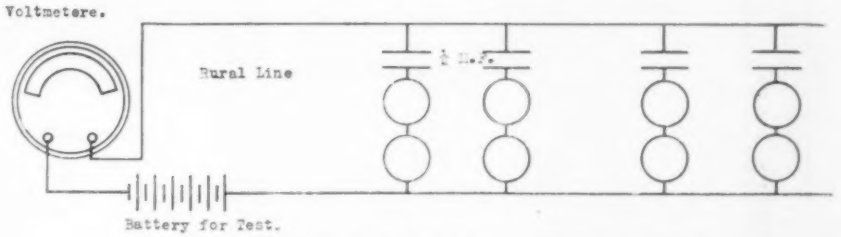
Schematic Circuit of Magneto Rural Telephone with Condenser in Receiver and Ringer Circuits.

Fig. 151

nected to this line, that aside from a momentary deflection of the voltmeter needle, the line would test as though it were open. Now if the line in Fig. 141 were equipped in this manner, it would test open. Then if a short circuit came on the line at subscriber 7 the voltmeter would at once show the presence of such a trouble. The distance to the short could be measured, but this distance would not tell what branch of the line the trouble is on. A distance of 12 miles might be the reading of the meter, with a short on at subscriber 7. But the distance to subscriber 4 might also be 12 miles. So that the use of the direction finder would after all be needed to show which branch of the line to follow. There are certain advantages in having the loop of the rural line as in Fig. 152. However, do not make any change as suggested unless you have authority to do so, and then it might be as well to change one or two miles only until the results can be observed. We will continue the discussions of testing and central office test sets in the next chapter.

Japan has more telephones than any other country in Asia.

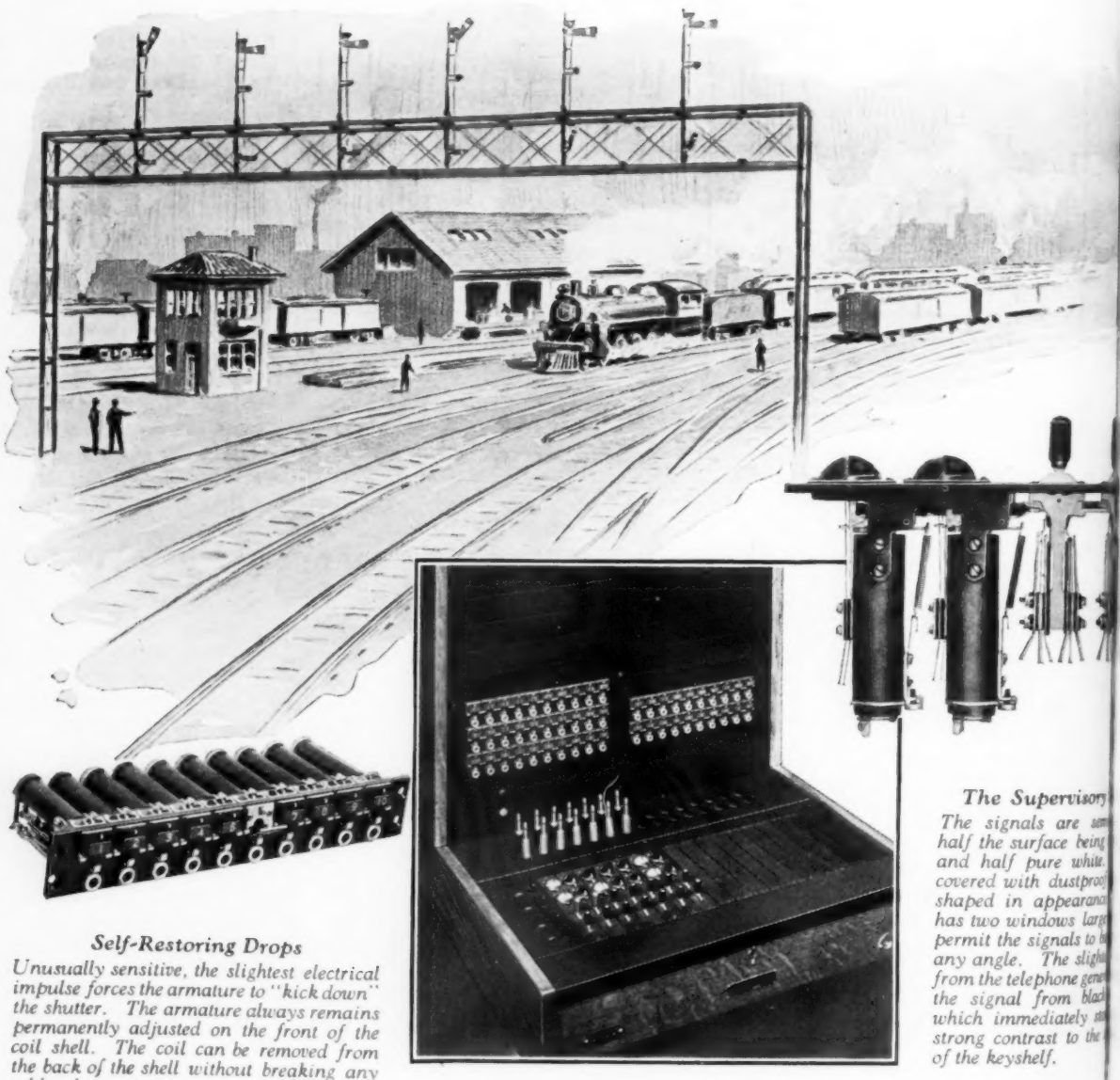
San Francisco has more than 32 telephones per 100 population.



Schematic appearance of the Ringer Circuits of Rural Line with Condenser in series with Ringers and Receivers.

Fig. 152.

Signals That Demantt



Self-Restoring Drops

Unusually sensitive, the slightest electrical impulse forces the armature to "kick down" the shutter. The armature always remains permanently adjusted on the front of the coil shell. The coil can be removed from the back of the shell without breaking any soldered connection.

The Supervisory

The signals are sem half the surface being and half pure white. covered with dustproo shaped in appearanc has two windows larg permit the signals to b any angle. The slight from the telephone gene the signal from blac which immediately st strong contrast to the of the keyshelf.

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ttention and Action

COMMUNICATION, like transportation, is controlled largely by signals. The progress of both has been in direct proportion to the advances made in the signalling equipment.

Consider the operator of a switchboard. The service she gives is determined by the speed which she responds to the signals of the board. The two essentials of these signals are: they must be easy to see, and they must be positive in operation

Each detail of construction of our type 5001 Magneto Switchboard reflects the attention given to these two essentials. The new supervisory signal and key, comprised of two clearing out signals and a ringing, listening and ring back key in a single unit, is mounted in the keyshelf in front of the cords and out in clear view of the operator. As they are directly aligned with associated cords and plugs, there can be no confusion in determining which subscriber has rung off. Standing out with unmistakable clearness, they enable the operator to handle all calls with ease and sureness and at a speed that closely approximates that of common battery service.

The equipment of this magneto switchboard is standardized to meet every necessary requirement of the magneto exchange, without alterations. This standardization of parts enables us to keep in stock, ready for immediate shipment, boards wired for 50, 100 or 150 lines with 15 cord circuits and equipped as follows:

Code No.	Lines Equipped	Cord Equip.
MC-5001-A	30	6
MC-5001-B	50	8
MC-5001-F	60	10
MC-5001-C	80	10
MC-5001-D	100	12
MC-5001-E	120	15

American Electric Company, Inc.

State and 64th Streets Chicago, U. S. A.

Branch Office and Warehouse--
7th and Wyandotte Streets, Kansas City, Mo.

Practical Suggestions for Plant Valuation

By CHARLES W. McKAY, M. E.*

CHAPTER XII.

In concluding the last installment it was suggested that in this installment we would discuss the conditioning of the general equipment group of accounts (accounts 261 to 265, both inclusive) and then proceed with a discussion of the collateral construction costs. In the meantime, however, several thoughts have suggested themselves to the writer. Thus far, we have confined ourselves to a discussion of the condition of the outside plant, and we have not touched upon the real estate accounts, nor the central office and subscribers' equipment accounts. Hence, before taking up a consideration of the general equipment accounts, we will drop back a little and refer to the groups of items which we have unintentionally overlooked.

Land.—There are many reasons why land does not depreciate—if we adhere to the ordinary usage of the term "depreciation." Of course it is quite possible that the monetary value of a certain parcel of land may decrease, over a period of years—but it does not suffer the ordinary losses attributed to depreciation, i. e., loss due to wear and tear; losses due to age and physical deterioration and losses due to inadequacy and obsolescence. In passing, it may be well to remark that the factors within inadequacy and obsolescence might, quite conceivably, be considered in determining the present value of land at the date of appraisement. It is not customary to do so, however, nor are such factors usually considered in court and commission cases.

It may be well to amplify the foregoing by brief quotations from one of the writer's own books:

"For obvious reasons land does not depreciate in the sense that we have been using the term 'depreciation.' In other words, land is something that cannot wear away, or undergo a lessening in value from physical causes. It is true, however, that the value of land does depreciate and also that a parcel of land used by a telephone company may become inadequate to serve the purpose for which it was originally purchased.

It may be that on this basis a logical argument could, under certain conditions, be advanced for setting up a depreciation reserve fund for the item land. Take, for instance, the case of a telephone company having a central office so located as to be in the approximate center of its subscriber development. Assume that for certain reasons, which could not possibly be foreseen at the time the land was originally purchased and the central office built, the telephone development in the area fed by this particular office has gradually shifted, without appreciably increasing, so that the telephone center is at some distance from the original central office location. Let us further assume, for the sake of argument, that this shift in population has been accompanied by a marked decrease in property values in the immediate vicinity of the telephone exchange. In such a case not only would the land have actually depreciated in monetary value but it would have become "inadequate" to serve the purpose for which it was originally purchased.

If cases of this kind were frequently encountered there might be some logic in arguing that land is depreciable. However, from the standpoint of everyday telephone practice land is *not* depreciable, although its monetary value may show a shrinkage over a period of years. On the other hand, the value of land is perhaps even more likely to appreciate, at least in prosperous and rapidly growing communities."

On the other hand, it is true land does appreciate in value. The subject of land appreciation, while it is slightly beyond the pale of the present discussion, is most interesting. Dr. Milo R. Maltbie has advanced several arguments which are interesting, to say the least. Dr. Maltbie reviews the question of appreciation and depreciation from a slightly different angle from most of the utility experts, and in view of the fact that Dr. Maltbie's long association with the New York Public Service Commission and the Interstate Commerce Commission warrants a serious consideration of his views, we quote from him as follows:

"For the purposes of this discussion it is assumed that the theory that land is to be valued according to the present value of contiguous property is sound. It means, of course, that as the land increases in value, or rather as adjacent land increases in value, the land belonging to public utilities increases in value—that it is to be distinguished from other property which decreases in value from year to year, and that such land has an annual increment or an average annual increment in value from year to year.

"I want to call your attention to one other major premise. The argument usually runs something like this: As in fixing fair value one takes the present value of physical property other than land, so one must take the present value of land. Hence as physical property decreases in value—becomes less valuable as time passes—they are treated equally. As Judge Hough says, it is treating the plus and minus quantities alike. That is the argument for taking land at its appreciated value when you take other physical property at its depreciated value.

"What is the next step in the treatment of physical property? It is said that inasmuch as physical property other than land becomes less valuable as time passes, and must ultimately be replaced either by property of the same kind or of similar kind, there must be an allowance made in operating expenses or added to operating expenses to take care of that depreciation from year to year. I will use a simple illustration and eliminate complications.

"If you have a car worth $5,000, which is to last twenty-five years, it decreases in value from year to year, and you must ultimately replace it. You must allow about $200 (that is, $5,000 divided by the time) in expenses or added to operating expenses each year in order to replace the car at the end of the time. I call your attention to the fact that those who believe in that theory do not say that you must necessarily spend $200 a year as you go along, but that you must accumulate a fund which will provide for the replacement of the car when it ultimately ceases to be used.

"The money is not actually spent, but it is treated as an operating expense; it goes on that side of the account just as if it were for coal or labor and actually paid out. Such is the treatment of depreciation that is supported even by those who do not agree that in determining the fair value of the property one should take the depreciated value of the property.

"Let us pass from that kind of property to land. Now we are on the other side of the ledger, and we have something which instead of decreasing in value increases in value from year to year. That annual increment, if it is to be treated precisely

*Note.—Questions will be gladly answered if referred to the writer care of "Telephone Engineer," 236 North Clark street, Chicago, Ill.

as you treat depreciation on the operating expense side of the question, must be treated as an income or put on the income side of the account.

"What are some of the objections to this theory? In the first place, it is objected that the annual appreciation is not an income—that one is putting down a suppositious income, not a real income. Is a depreciation allowance that is accumulated against some future day an actual outlay? Hence, to say that appreciation is not a real income is no more of an objection than to say that depreciation is not a real expense. One is just as real as the other.

"But let us see whether or not the appreciation of property is not, after all, equal to a real income. Suppose you have land costing $100,000, and your rates are fixed on that basis at the time you buy the land. In ten years, we will say, it had increased to $200,000 in value. If the theory is correct that the public must allow a return on the present value of the land, you are entitled, after ten years, to charge enough to secure a fair return on $200,000.

"If you get an income on $200,000 when you have an investment of only $100,000, what do you want better than income of that sort? I do not know how you feel about it, but I would be satisfied. If I could invest $100,000 in a piece of land, have an income on that $100,000 every year, and as it increased in value from year to year, get an income in addition on an annual increase of $10,000 (the first year $100,000; the second, $110,000; the next year $120,000; and so on up to $200,000), I would laugh at any one who said I was not getting an equivalent to an income of $10,000 yearly on and above my original investment.

"Suppose you went to New York and talked with families that have owned land on Manhattan Island almost from the time the original settlers got it from the Indians, and suppose you said to them: 'Neither you nor your ancestors ever got any income except a return upon the original cost upon the basis of $24 for the Island of Manhattan.' They would probably tap their heads and say: 'Nobody at home.' And they probably would add, as Al Jolson says: 'Not only is there nobody at home, but nobody has ever resided there.'

"Some of you probably have to make out an income tax return. Try that theory on the treasury department next spring, and see what the treasury department will say about it. Say: "Yes, my land increased $10,000 in value this year, but it is not income, it is a fictitious thing to me.' You will find that the jail into which you go is not fictitious.

"The second objection is that increase in land values is not definite; it is uncertain: it is intangible. But what is done in the case of depreciation? An engineer comes along and says this property is going to last so long, and so much should be set aside for depreciation. Probably that is the best that can be done at present, but it is less certain than appreciation, because the moment one says that certain land is today worth $200,000 and cost $100,000 ten years ago, or its value was $100,000 ten years ago, you know what the appreciation was during that period.

"The further objection that I have heard is: 'Well, that must be part of the single tax theory.'

"There are three things in this world that you do if you want to eliminate your antagonist. In the first place, you may say he is a socialist; that just about disposes of him. He is then beyond the pale of all reason, no matter what he is saying. If you cannot do that, you call him an 'impractical man,' and say: 'We must deal with things practically.' Of course, that is a knockout blow. But if he still survives, call him a single taxer, and say it with bated breath, for such should hardly be found in decent society.

"But it is not a question of whether it is socialism or single tax. Is it common sense? If you hold to the theory, which I believe to be sound, that depreciation must be taken account of in operating expenses or added to operating expenses, you must admit that appreciation in land values from year to year must go down on the income side as an offset. Take land and buildings! Land appreciates and buildings depreciate.

"If you do not believe in the theory, you say depreciation on the buildings must be put into operating expenses, but you will not allow appreciation on the land to be put on the income side. What does every one do? Every one figures that if the land goes up in value as much as the buildings go down he has just as good a property at the end of the year as he had at the beginning. Why is it not logical to offset in public utilities appreciation of land against depreciation of the buildings? If it is logical as applied to land and buildings it is logical as applied to other property."

To clarify this whole subject of land appreciation and depreciation, the engineer does not have to concern himself as to the "condition" of the land. He must ascertain the reproduction cost today—in other words, present market value of the land—and the figure thus obtained should show in the appraisal under both "Reproduction Cost" and "Present Value" columns in the detail and summary sheets.

Buildings.—The life of a telephone building is extremely difficult to determine. It depends upon the type of building; the quality of workmanship used in the construction, and the use to which the building is put. Broadly speaking, the type of buildings used in telephone work have an extremely wide range of life.

In determining the condition for appraisal purposes, the engineer must first determine the actual condition—from the standpoint of wear, tear, deterioration and physical decay.

Having arrived at the proper percentage (applicable to the reproduction costs) resulting from these factors—the engineer must also look into the future and try to determine whether or not the building will be suitable for its present telephone purposes, from the standpoint of inadequacy and obsolescence.

The final condition per cent will result from a proper weighing of these two factors—physical depreciation and functional depreciation.

In the July installment I will have a little more to say on the subject of inspecting buildings to determine the present condition—both from the standpoint of wear, tear, age and physical deterioration and from the standpoint of inadequacy and obsolescence. We will then take up the subject of conditioning subscribers' station and central office equipment—and the items of general equipment.

Longest Telephone Line

Two long distance telephone circuits recently opened between New York and Los Angeles, a distance of 3,412 miles, constitute the longest direct telephone circuits in the world and represent one of the latest achievements of telephone engineers.

Up to this time, calls between the Atlantic and Pacific coasts had to be switched at Chicago. The new direct line goes through Chicago to St. Louis and thence over the southern continental line to Los Angeles. Telephone repeaters boost the current at various points, so that it is almost as easy to telephone from coast to coast as it is to telephone across a street.

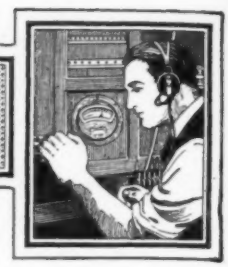
The voice over this line travels a longer distance than over the trans-Atlantic wireless from New York to Scotland or over the return from Rugby to Houlton, Maine. The distance from Rocky Point to Scotland is 3,200 miles, and from Rugby to Houlton, Maine, 2,930 miles. American telephone service is not even approximated in other countries.

Radio Telephone to Airplanes

Experiments that may result in radio telephone communication between airplanes and any telephone on the wire lines of the Bell Telephone System are to be undertaken at Hadley Field airport.

Company officials said that development of the necessary transmitting and receiving apparatus is already well advanced, and supplementary tests in the air will begin as quickly as the plane can be equipped with suitable radio apparatus.

LINE AND DESK



AN UNUSUAL CONDUIT JOB

A conduit job having some unusually difficult engineering and construction features was described in a recent number of The Cincinnati Telephone Bulletin. We are indebted to that publication and to its recently deceased editor, Werter G. Betty, for information and illustrations for the following description.

The Twenty Foot Deep Manhole at the Top of the Cliff

Those familiar with the geography of Cincinnati know that the principal business section is located in a basin on the north bank of the Ohio river and that the residence sections have grown till they cover a circle of hills surrounding the basin. Telephonically, the city is served from a group of offices in the basin section and a ring of offices located on the hills.

Warsaw office serves an extensive area on the hill tops to the west of the downtown section. The nearest downtown office is West office and the conduit job became necessary to provide space for additional trunking cables between the two offices.

The distance between State avenue at the foot of the hill and Lehman road at the top is 720 feet, but the difference in elevation is 300 feet, part of which is due to an 80-foot cliff. The hill formation is of blue limestone. For 640 feet the six

View of Trench and Tunnel at Base of 80-Foot Cliff
Laying Duct in the Trench

duct conduit was laid in trench excavated in the rock. The grade of the trench was approximately one to three and considerable difficulty was experienced in getting material into place. The duct was completely encased in concrete and concrete headers about 100 feet apart were installed to prevent the duct from slipping.

At the top of the cliff a manhole ten feet square by twenty feet deep was excavated. A tunnel was driven from the trench below through the face of the cliff to join the manhole and the duct was laid through the tunnel. The accompanying illustrations give some idea of the conditions under which the work was done and the difficulties encountered.

"BUGS WE HAVE SHOT"

I thought I had heard of every kind of telephone trouble that could be imagined, but here is one on me. A few years ago I told, through TELEPHONE ENGINEER, of a pet coon that had climbed a toll line near Benton, Ark., and crossed all the lines with a brass chain that was around his neck, but here is an item clipped from the Little Rock Gazette of May 2:

"Three catfish and two perch put a Blytheville telephone out of order for a short time recently. Lee Musgrave, repairman, called to investigate local line trouble on Franklin street, found the string to which the fish were attached wrapped around the circuit, effectively "shorting" it. Apparently the catch had been thrown away by some fisherman and had become lodged in the line. The lineman restored the service by removing the string."

Contributed by J. P. Whitson, Hope, Ark.

"TRAIN HIM TO GET THE BEST OUT OF HIM

"Hello, Dick. Out with your dog again?"

"Yes, Tom. He is quite a chum."

"Gee Dick, I would give anything if my dog was as smart as yours and could do as many clever tricks."

"Your dog is just as smart as mine if you will spend some time in training him. If you want him to bring your paper you must teach him. He will not teach himself. To get the best out of him you must train him."

This little imaginary conversation has a point because a man like a dog must be trained if he is to give the best that is in him. Most men have a lot in them and only need help to get it out.

Mr. Employer, furnish your men with plenty of reading matter, proper equipment to test with and the right kind of tools to work with.

Mr. Man, make use of the tools and equipment furnished you. Add to your information by exchange ideas with others through the columns of papers like TELEPHONE ENGINEER. Do not think your ideas are small or unimportant. Some other fellow may want to know something about the thing that you know.

Do not be afraid that your questions will sound foolish. The man who laughs at other men's mistakes usually is the one that knows the least. Ask questions; give your answer to others that are asked. No one will laugh at you.

Mr. Benedict, Mr. Sylvester and others have started something. Let more men talk like them. If we want better men and more information, let's keep asking for them till we get them.

When we lose anything we lose it accidentally. Let's not wait and lose our ideas the same way. The writer will have something to say from time to time. Some of the rest of you do the same thing.

Contributed by A. Windsor McKay.

THE FOREMAN IN ACCIDENT PREVENTION

Infractions of rules and regulations, failure to obey instructions, attempting work outside the line of duty—in general, shortcomings of the human element—constitute the background and stage, the cause and major problem, of the industrial accident situation today. The foreman, by virtue of his opportunities for observation, his close contact with the workers, and the fact that he is the nearest person in authority and is ever present, should be held responsible for the correction and elimination of these accident creating factors. Until he does fulfill his obligations in these respects there will be accidents for which he cannot divest himself of the responsibility. —*Travelers Standard.*

Raise of Telephone Rate Is Requested

Two applications to raise telephone charge rates and one to construct a toll telephone line were filed with the state corporation commission by the Midland Telephone Company of Garber, Okla.

Increases in rates from $2.50 to $3 for business telephones and from $1.50 to $2 for residence telephones are asked for exchanges in Marshall and Lovell.

Telephone Exchange Sold

Van Horn, Texas.—E. M. Bilberry has sold the telephone exchange at Sierra Blanca to E. D. Simpkins, owner of the exchange at Fabens, but Mr. Bilberry will remain as local manager at Sierra Blanca.

Up-State Telephone Association Holds Three Day Business Session at Rochester

In his annual address before the Upstate Telephone convention at Rochester, N. Y., May 24th, President J. G. Ihmsen outlined businesss conditions in that state, and gave a resume of the work of the association the past year. Mr. Ihmsen's address is printed below:

"It is a pleasure to call attention to the general prosperity which the telephone industry has experienced during the year 1927. An increase in both gross and net earnings is reported by both large and small companies, and there appears to be a general feeling of satisfaction among the managers and owners of telephone properties.

Although growth in rural sections is the least noticeable, owners of small telephone properties are more contented, and in many instances optimistic, in their attitude toward the future. It is believed, that the improved sentiment is the result of increased knowledge which the managers and owners have acquired regarding the telephone business as a whole, and their own properties in particular.

Contact with other telephone people has dispelled the feeling of isolation which formerly existed. The discussion of their telephone problems has enabled them to accumulate knowledge of the business. Through your telephone association they have been made able to realize the importance of their telephone plant as a link in the scheme of nationwide telephone service.

As a result of the advice and instructions received from those who have had broader experience, they have put into effect better management, which has resulted in improved traffic conditions, betterment of plant and equipment, and some system of accounting, whereby a more acurate knowledge of their property value is obtained.

It is noticeable that companies which are active in the association and attend the annual and district meetings, are the most progressive and show the greatest improvements in their physical and financial condition.

All the district meetings were liberally attended and were regarded as successful, but the plan of serving the same number of people with fewer meetings did not work out and was more or less disappointing.

No association telephone meeting in this state will acomplish its purpose without the liberal aid that is now being given by the Friendship group, the larger Independent companies and the New York Telephone Co. system. It is the presence of experts from those companies that enables the association to carry on intelligent discussion of all telephone questions brought up at the meetings, and it would be pleasing to see this representation increased rather than diminished. The other element necessary to our success is a liberal representation from small telephone companies. This, I believe, can be best accomplished by having a larger number of small one-day meetings in localities close to those groups.

The lecture and demonstration showing electrical hazards was the outstanding feature of district meetings, at which it was shown.

During the year 1927 eight telephone companies changed hands, either through purchase or consolidation. These properties all passed into the hands of capable operating groups, who are interested in the development and operation of telephone systems for the purpose of giving high grade service, at rates that are reasonable and fair.

The advisability of bringing all of the eligible small companies under commission jurisdiction has been discussed and urged at all of our meetings. It has required several years to dispel the fear of the commission supervision and persuade the small company management that benefits would accrue to their company, under commission control.

It has been well known that the plant value of many companies was sufficient to bring them under jurisdiction and while the process has been slow, many have been induced to withdraw their opposition, with the result that since my last report seven such companies have consented to commission jurisdiction.

Twenty telephone capitalization cases were brought before the commission, all of which have been disposed of. For the 12 months ending November 30, 1927, 30 telephone tariff revisions were filed with the commission, nine of which provided for increased rates.

Two hundred and twelve central office districts were inspected by New York Public Service Commission inspectors during the year. Recommendations offered by the inspectors for the improvement of service have been willingly complied with. Thiss willingness to accept suggestions for the betterment of service has placed the small companies in good standing with the commission.

I feel confiedent in stating that the changed attitude of many small companies, from a determination to do nothing into a desire to do what can be done within their means, has been influenced to a great extent by the activities of your association.

The operators' school, or traffic conference as we prefer to call it, enjoyed its usual popularity and has met with enthusiastic approval from the division and traffic chiefs of the large companies.

The new plan of selecting a leader for each traffic conference from the district in which the meeting is held was followed as closely as possible. There was some complication and uncertainty in the beginning, and there may not have been as much precision and perfection as formerly, but the experiment has established the fact that there are enough talented operators located in the several districts, who can with a little practice, learn to conduct the traffic meetings in a satisfactory manner.

Your directors have decided that distric telephone meetings will be conducted during the coming season upon practically the same plan as heretofore and that one-day meetings shall be the rule, excepting where some especial occasion may demand an extension of the time to a second day."

(Continued on page 41.)

Gathering at Harrisburg Represented Real Telephone Interests of Pennsylvania

Over at Harrisburg, Pennsylvania, on May 15, 16 and 17, was one of the representative Independent telephone meetings that does a fellow's heart good to attend. While the gathering was not unusually large, it did have the spirit of interest that manifests itself in the different subjects discussed.

F. B. MacKinnon, president of the United States Independent Telephone Association, addressed the convention on the subject of "The National Situation." His address was similar to that delivered at other state gathering, but nevertheless interesting and instructive.

Those registering were given a theatre ticket for the Tuesday evening shows. Wednesday evening a banquet was enjoyed by several hundred. Several telephone men and manufacturers spent an afternoon on the golf links.

Tuesday an operators' conference was conducted by Miss Rosalia Shiber, chief of toll traffic of the Johnstown Telephone company, assisted by Miss Edna Bateman, chief toll operator Cumberland Valley Telephone company. Sessions were also held Wednesday and Thursday. These sessions were well attended by operators from over the state.

The domonstration conducted by Mr. Sergius P. Grace, general commercial engineer Bell Telephone Laboratories, entitled "Science and Research in Telephone Development," attracted a great deal of comment. This talk should be heard by every man in the industry. Mr. Grace demonstrates what has been accomplished in the laboratories during the past few years.

The following is an outline of the president's address, as delivered by Mr. Bradley:

Instead of presenting to you the old style annual report, made up of a detailed statement of the routine work of your Association for the past year, I have chosen as the subject of my talk, "Looking Backward and Forward."

It was on October 31st, 1902, over twenty-five years ago, that a meeting was held in Philadelphia, attended by ten men. Nine of these represented six Independent telephone companies, three in Pennsylvania, one in New Jersey, one in Delaware and one in Maryland. The tenth party at this meeting was a rather young man, equipped with four years' telephone experience and an idea to sell.

The object of that meeting was set forth in the remarks of the chairman (and I quote from the minutes) as follows: "The Independent Telephone Companies operating in Pennsylvania, New Jersey, Delaware and Maryland, are getting near the point where toll business will be an important item and some agreement must be entered into between the various companies to standardize rates, issue schedules and instructions for handling toll messages, pass on standard form of toll tickets and adopt standard rules for the handling of interchanged business." You must admit that this was an ambitious program.

That was the beginning of association work in Pennsylvania, in fact it was the beginning of this association, for the Eastern Traffic Association was the foundation upon which this association was erected.

The Eastern Traffic Association was organized, primarily, as a clearing house for the purpose of making settlements between companies for interchangeable toll business and that function has been continued in this association as the toll clearing department.

You will be interested to know that as early as 1905 it was suggested that we move to Harrisburg. That the proposition did not find favor with tne executive committee is shown by the fact that headquarters remained in Philadelphia until more than fourteen years later.

In 1910 came the creation of the Pennsylvania Railroad Commission which many felt would be a detriment to our business. Being law abiding citizens however it was resolved, at a meeting held on August 17th, 1910, that all companies cooperate with the commission and furnish all information as to exchange and toll rates, provided such information be not detrimental to the interests of the company. The Railroad Commission, however, paved the way for the Public Service Commission, which was, I believe, accepted in better faith.

Early in 1911 appeared the first storm clouds of dissensions which later resulted in the disruption of the National Association. On June 26th, of that year, resolutions protesting against the physical connection of Independent and non-Independent telephone companies were passed and presented to the directors of the National Association. Many of you will recall the battle in the national convention of February, 1911, which resulted in the withdrawal of the Pennsylvania delegation. During the following two years the Independents of Pennsylvania were busy and early in 1913 a meeting was held in Pittsburgh, attended by delegates from Pennsylvania, Indiana, Illinois, Wisconsin, Minneapolis and several other states, and the Independent Telephone Association of America was organized. Contrary to the predictions of many, two successful conventions were held, in Chicago in January, 1914, and in Minneapolis in January, 1915. That association grew and prospered and in January, 1916, through the adoption by the old National Association of the Independent principles as defined by the constitution of the Independent Telephone Association of America, the two associations were brought together in the United States Independent Telephone Association. I believe we may take just pride in the fact that it was the stand taken by Pennsylvania which preserved the independence of our national organization.

In 1911 the Western Pennsylvania Independent Telephone Association was organized, followed in 1913 by the Eastern Pennsylvania Independent Telephone Association. After the close of the war it was felt that Pennsylvania should have but one association and on December 1st, 1919, the three associations were brought together in the Pennsylvania State Telephone & Traffic Association. As before stated the Eastern Traffic Association was made the foundation for the new association, the offices moved to Harrisburg and the scope of its work enlarged to include all Public Service Commission and other departmental activities. Included in this was the watching of all bills presented to the legislature. It was the passing of the telephone act of 1919 and the supplemental act of 1921, which has made possible the merging of telephone properties in this state. Both of these bills were backed by the members of this association. Other legislation favorable to our industry has been passed and still other bills have been killed which were, in one way or another, detrimental.

Before the Public Service Commission our work has entered into every department. Nearly five hundred tariffs and supplements have been filed through our office and many of these were also prepared by our clerical force. Many hearings have been attended and many complaints have been satisfied without a hearing. Petitions have been prepared and presented and followed to a successful conclusion for several companies. Merger proceeding in the Bureau of Corporations as well as before the commission have been followed up and much time can be saved by the personal attention given to such matters by the representative of your Association.

Since 1919 the toll clearing department has continued the clearing work of the old Eastern Traffic Association and nearly $10,000,000 in interchangeable tolls have passed through our office. This service must be fairly satisfactory to our companies as we seldom have a complaint.

So the years have rolled by, each with

its problems, some new but most of them as old as the industry itself. Back in 1908 we find Karl Schotte fighting coupons and he is still at it. About 1912 Pop Schade and Pop Wilson began arguing for and against depreciation and nobody knows when John Wright started raising rates.

1928 is what we term an easy year because we have no legislature in session. However, we have one to prepare for and we can only guess what is before us. There are two bills we can be sure of—one to abolish the Public Service Commission and one to increase its powers. On bills affecting our industry we must take a definite stand and once for or against, we must have concerted action. The strength of your Association lies in the fact that it is made up of many, united as one, to protect the interest of all.

Wall Street Expects Big Stock Issues

New York.—Wall Street is preparing to digest stock issues by two of America's billion-dollar corporations which will probably reach an aggregate of $150,000,000. The corporations are the American Telephone and Telegraph Company and the New York Central Railroad, the former of which shares with the United States Steel Corporation the distinction of having more than a billion dollars of shares outstanding.

The issuance of stock in the amount of about $100,000,000 at par by the American Telephone and Telegraph Company is under consideration by the management to meet the growing needs of the company. The last time it offered stock was in 1926, when $154,127,600 was offered to stockholders at the rate of one share for every six held. This was the largest offering of stock the company had made, and after it was all sold, the company's outstanding capital stock totaled $1,103,415,000.

Meanwhile, however, the company has made enormous disbursements for expansion and improvement, as shown by an increase in its book assets, from $1,841,102,000 on Dec. 31, 1926, to $1,949,690,000 on Dec. 31 last. In 1927 investments in plant increased by $230,000,000 to $3,013,000,000. This year it is planned to spend more than $420,000,000 in additions to plant and equipment, which is the largest amount ever spent by this company, and possibly by any company, in a single year. Land and buildings will absorb $41,000,000 of 1928 disbursements, central office equipment nearly $110,000,000, subscribers' equipment $91,000,000, exchange lines $110,000,000 and the toll lines $65,000,000.

A. T. & T. Favors Stock Financing

The last bond financing done by the company was in 1925. Its large expansion requirements have all been financed by stock issues. In twenty-six years offerings of stock to shareholders have totaled nearly $700,000,000 and about 216,000 employes have bought the stock on special terms. The company favors stock financing largely through its value in enlisting public support through the creation of a large body of shareholders. While dividends have remained at 9 per cent since 1922, the shareholders receive extra remuneration through the valuable subscription rights issued from time to time.

In view of the company's operations and its known financial policies, offering of a substantial block of stock is considered a certainty this summer.

Mendel Fills Long Felt Need in Telephone Industry

Ernest J. Mendel, an operating telephone man and a specialist in matters of toll revenue division between telephone companies, who for the past three years has devoted all of his time to the problems of the Oklahoma-Arkansas Telephone Company with headquarters at Poteau, Okla., has now opened an office in Fort Smith, Ark., for the purpose of making his services available to Independent telephone companies in all parts of the country, who are interested in getting a fair and equitable division of toll revenues.

It is said by engineers, attorneys and operating telephone men who have come in contact wtih Mr. Mendel that he has more knowledge and information on the subject of division of toll revenue between companies than any other man they have met in their experiences.

This analyst is familiar with telephone conditions, commissions' and courts' decisions and connecting company agreements in all sections of the country.

The entrance of Mr. Mendel into this field will be welcomed by Independent telephone men everywhere. While Mr. Mendel was devoting his entire time to the Oklahoma-Arkansas Telephone Company he received numerous requests from telephone operators in all sections of the country, inquiring if his services were available to assist them in their problems. It is felt that these operators who previously wrote Mr. Mendel about his services will be glad to know that he is now in a position to assist them.

Mr. Mendel invites correspondence and says that all inquiries will be given prompt attention. When writing, address Ernest J. Mendel, telephone analyst, post office box 128, Fort Smith, Ark.

Speedwriting Messages by Telephotography

A hundred-word message, written in the new shorthand method known as speedwriting and placed on the same telephotograph with a picture, was put on the wires yesterday at the American Telephone and Telegraph Company's New York telephotographic station, 15 Dey street. Within seven minutes it had been received in Los Angeles.

It was explained by officials at the telephotographic station that the sending of the message marked a new development in telephotography. As many as 2,500 words could be sent over telephone wires in a single transmission, it was said. The limit for an ordinary typewritten message, sent as a single picture, is 800 words.

The sender of yesterday's message in speedwriting was Emma B. Dearborn of 200 Madison avenue, an originator of the speedwriting method of shorthand. The message accompanied a picture of Miss Dearborn, which she was sending to Ruth Roland, motion picture actress, in Hollywood. When words and picture were received in Los Angeles they were rushed to Hollywood and there the speedwriting was transcribed for Miss Roland, who telegraphed a reply.

According to telephotograph officials, the saving in actual space by speedwriting over an ordinary typed message on a picture-by-wire negative amounted to from 50 to 65 per cent, depending on the choice of words. The saving is greater in the case of long words than in short.

It requires an hour and a half from the time the message is delivered at the sending station before the transcribed message is in the hands of the person to whom it is addressed at the other end of the wire, it was said yesterday, although the actual time consumed in the sending is seven minutes or thereabouts.

The sending of speedwriting messages by telephotography comes less than two weeks after the first successful transmission of moving pictures by telephone.

Vermont to Hold Convention

Notice has been received that the eighth annual convention of the Telephone Association of Vermont will be held at the Van Ness House, Burlington, Vt., Thursday and Friday, June 21st and 22nd. A good program is promised.

Pennsylvania Promises Good Meet

Those in charge of the program of the Tri-State Telephone Association assure us that nothing will be spared to make this one of the best meetings of the year. The convention is scheduled for August 8th, 9th and 10th.

Broadcasting Radio Programs by Telephone

By E. L. POTTS

Chief Engineer, United Telephone Co., Yale, Okla.

The success of the Program Service System of today is dependent upon several factors. The most important of these are quality of reproduction, selection of program, and cost to the patron. Without good reproduction, no program service can be more than a novelty and cannot hold its patronage. Without good selection of programs and features it will soon lose its appeal and cease to be of interest or value. If the cost is too high, the patronage will be too limited to be practical.

The quality of reproduction is dependent mainly upon the design and engineering of the equipment and plant. In order that the output of the speaker in the patron's home be even fairly good, the source of entertainment must be good. As the program may come from several sources, each must be considered as being a problem in itself.

If a radio set is used, it must be capable of separating the various stations well, but must not tune so sharply as to cut sidebands, with the resulting loss of quality. In this respect the set using several rather broadly tuned stages in cascade seems to be the most practical, as it is selective, but does not show a sharply peaked resonance curve.

If the program originates in a studio, the problem is more complicated. The studio should be on a par with the better broadcast studios, acoustically. The microphone should be properly placed and capable of reproducing equally all frequencies from 50 to 5000 cycles, with very little drop at the higher and lower ends of this range. Of the various types, the most satisfactory and durable seem to be the double carbon buttonstitched diaphragm type, as made by Western Electric and Kellogg, and used for broadcast work.

If an electrical "pickup" is used for the reproduction of music from victrola records, care should be used in selecting a pickup unit. Of the various types tested at Yale, the Victor and Stromberg Carlson seem to yield the best results. In connection with these a filter should be used which cuts off all frequencies above 4500, in order that the scratching noise made by the needle may be eliminated.

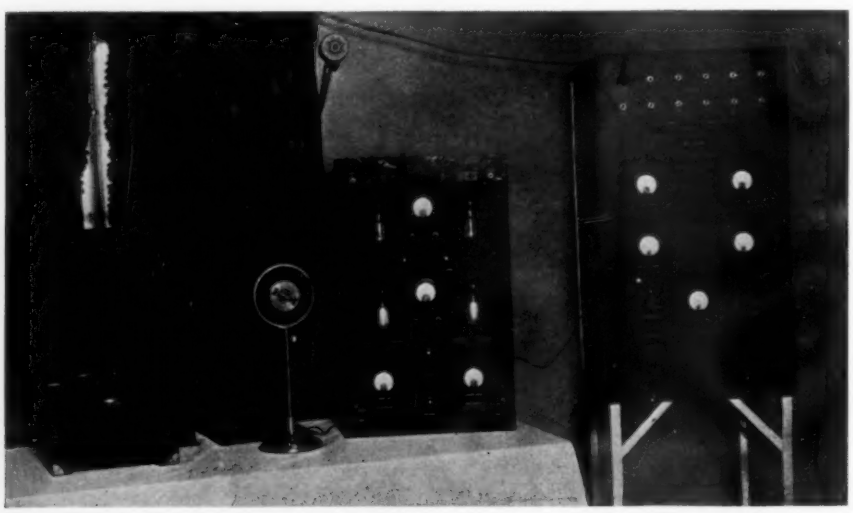
From these various sources the program should be conveyed to the point of distribution, usually the central office, over an open wire or cable circuit. The latter is to be preferred, as it is not nearly so subject to induction or other outside interference. To compensate for the losses in this line, and to carry the volume level high enough to overcome what interference may be present at different times, a line amplifier is necessary at the source. This amplifier should be designed so that it amplifies equally all the frequencies over the useful range, and should be operated at all times considerably under capacity to avoid the introduction of undesirable noise. The line into which it works should be carefully balanced on the same plan as those now used for remote control broadcasting.

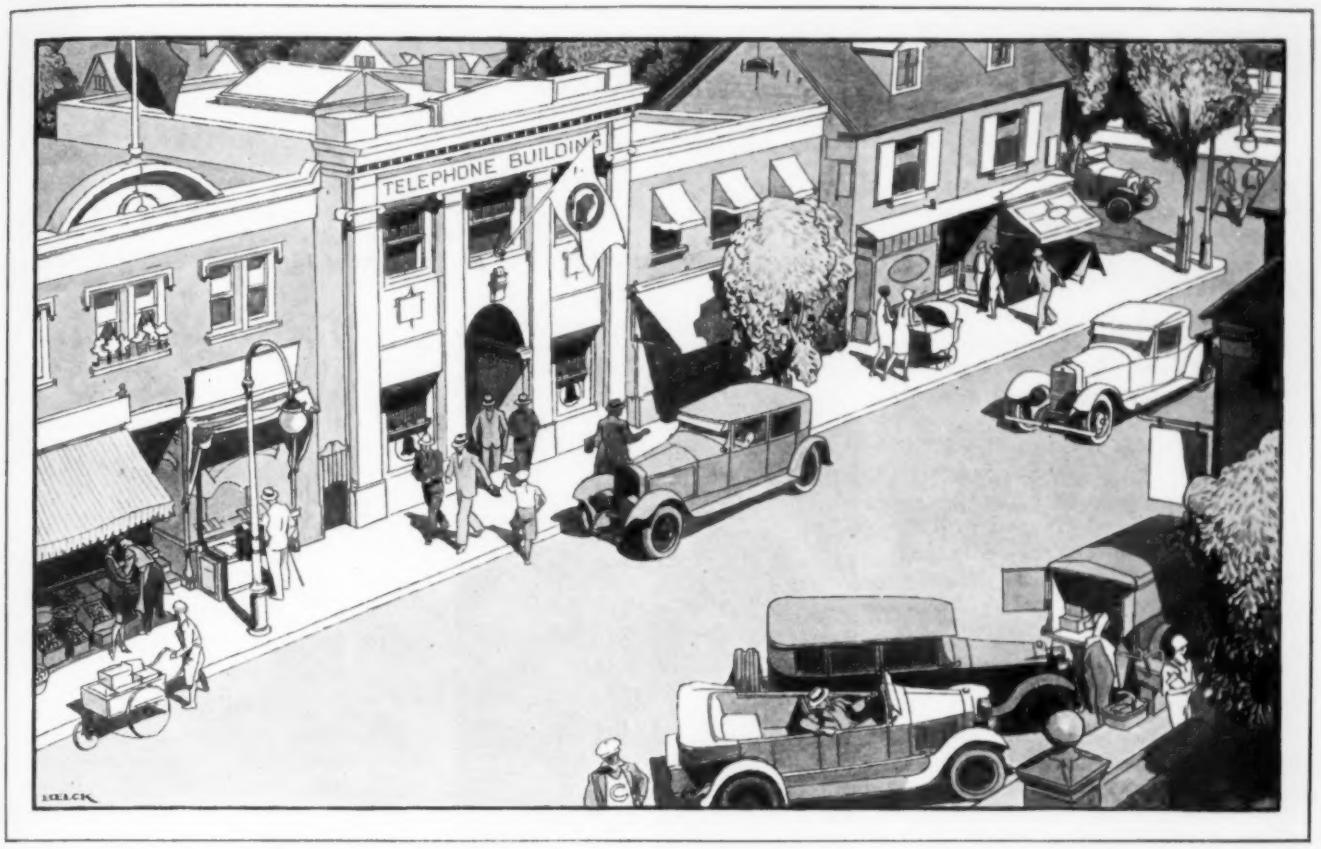
Before discussing the distribution equipment it is necessary to consider the facilities available for that purpose. At the present stage of development there are two systems in use. One, developed by Kellogg, uses a form of carrier system somewhat similar to that of the present radio broadcasting system. The cable is cross-talked by a carrier at a frequency above audibility, and this carrier is modulated by the program in the same way that the carrier of the broadcasting station is modulated. This takes the program to all points in the cable, but does not interfere with the use of the wires for telephone work, as it is above audibility. In the patron's home is a device very similar to the modern radio receiver, which brings the program back to its original form and amplifies it so that the speaker may be operated at a sufficiently high level. This system is excellent from the standpoint of reproduction, but the cost per station runs rather high.

Another system being developed by the United Telephone Corporation, Stromberg Carlson, and several others carries the program over cable pairs or open wire circuits at an audible frequency. In the use of this system several difficulties are encountered. The cable circuit has the property of by-passing the higher frequencies, and if provision is not made to offset this condition, the higher notes are lost and the output at the speaker is not natural. To offset this condition the amplifier must have a rising characteristic or the lower notes must be suppressed proportionately, so that the output at the speaker assumes its original form. This is quite a problem and calls for careful design and construction of equipment, and carefully balanced line conditions.

Another problem that presents itself is that of carrying sufficient power over the cable circuit to operate a number of speakers. Amplifiers can be constructed with sufficient output to handle a larger number of speakers, but the insulation in the cable would not stand up under their output. Thus we must use a number of cable pairs and separate amplifiers, or the output of one amplifier divided between a number of cable pairs, or an external circuit that will carry the large load without breaking down.

These conditions, along with a number of others which I do not have time to discuss, determine the comparative value





A home town enterprise backed by national experience

An Advertisement of the American Telephone and Telegraph Company

THE Bell System is a home town enterprise in operation so that each community may have service that suits its needs. It is a national enterprise in research, engineering and manufacture so that every telephone user may have the best that concentration and quantity production can achieve.

There are twenty-four operating companies devoting their energies to telephone problems throughout the United States—for example, the Northwestern Bell Telephone Company operating throughout Iowa, Minnesota, Nebraska, North Dakota and South Dakota. It has 11,000 men and women—friends and neighbors of the other people in their towns—working to maintain in its territory the best standards in telephony now known. In New York, in the American Telephone and Telegraph Company and the Bell Laboratories, are 5000 persons, including scientists, engineers and consultants in management, engaged in inventing better apparatus, and discovering better ways to do things.

The Northwestern Company with its 11,000 employees has the use of all that this group of 5000 in New York discover and perfect.

Likewise the other twenty-three operating companies. They are regional organizations adapted to local conditions, but behind every telephone in city or hamlet is the national organization for the development of the telephone art.

of the two systems. A careful consideration of cost as compared to returns show that for installation serving up to 300 subscribers, the direct method of transmission shows a much higher return investment ratio, while above that number the carrier method is shown to be more practical. Thus the system to be used is governed by the size of the installation.

The cost of operating either of the above systems from batteries would be prohibitive. It is, however, a simple matter to design this equipment so that it is entirely operated by alternating current. This will reduce very materially the operating cost, and make remote control a very simple matter.

The loud speaker in the past has helped to compensate for the poor transmission through the cables, because of its low response to the lower frequencies. The newer speakers, however, give very good reproduction down to below 50 cycles, and to use them the Program Service System must be well engineered. The development of the new Stromberg Carlson cone has helped us a great deal because of its excellent response to the lower frequencies, and its trouble free operation. No speaker can be expected to operate, however, with insufficient input. It is useless to expect the output of one or two 171 type tubes to drive from 20 to 30 speakers. The power output of the 210 type tube so popular today is only about 1½ watts operated as an amplifier, and no speaker in use today will give good reproduction with good volume on an input below .2 watt.

The Yale Telephone Company has conducted a series of careful experiments extending over a period of several years. Since the formation of the United Telephone Corporation this work has been carried on, and has resulted in the new equipment now being installed in Yale. This equipment is entirely AC operated and controlled from the studio located at a favorable point for good radio reception. Several programs are available to the subscriber at the touch of a button and a volume control allows a variation of volume to suit conditions. The operation of this system is very economical, and the equipment is so designed that the failure of any one tube in the system only lowers the volume level about 5 per cent and places no overload on any part of the amplifier. Operating under these conditions the tubes show an extremely long life and low cost per hour of operation.

The Program Service System is an excellent source of additional revenue to the telephone man, and can, if properly designed and operated, became a real factor in the development of public relations.

Husband: "One more payment and the furniture is ours."

Wife: "Good, then we can throw it out and get some new stuff."

Colonel C. M. Tichenor New Kellogg Works Manager

The Kellogg Switchboard & Supply Company of Chicago, manufacturers of Kellogg A-C Radios, Kellogg A-C Tubes, Kellogg Telephone Equipment and Automotive Apparatus, announces the appointment of a new works manager—Col. C. M. Tichenor.

C. M. Tichenor

Col. Tichenor joins the Kellogg Company with a wide background of manufacturing experience gained in the electrical and automotive industries.

As a very young man, Col. Tichenor held his first executive position with the Roberts Motor Company of Clyde, Ohio, where he was superintendent. Later he was Superintendent and Divisional Chief Engineer of the Maxwell Motor Co. of Detroit.

When the Gray-Davis Company of Boston, Massachusetts, was organized to produce automobile lighting and starting equipment, Col. Tichenor was made Sales Manager of the Manufacturers' Division and later was placed in complete charge of Manufacturing and Mechanical Engineering.

Col. Tichenor made an exceptional service record during the war. As a captain in the Signal Corps he was made Chief of Aircraft Engine Inspection with headquarters in Washington. During this activity he directed the inspection of all airplane manufacturing plants making government motors.

Late in 1917 Captain Tichenor was made Lieutenant-Colonel in the Signal Corps, at which time he and Col. Henry B. Joy mobilized and trained 14,000 skilled mechanics to assist the French army. Having completed this job, he was given the tremendous task of mobilizing and training the personnel for the American Airplane Assembly base at Romorantin, France. In addition to mobilizing the personnel, he was also responsible for laying out and planning the buildings and equipment for this big important base. Later he was made Chief of the Aircraft Armament Section which had to do with the furnishing of machine guns, bombs, bomb dropping apparatus and all fighting equipment for all the airplanes in the war service.

Upon leaving the service, Colonel Tichenor was connected with the G. W. Goethals Engineering Company of New York and later was in charge of the operating end of the Pierce-Arrow and Rickenbacker Motor Companies.

Colonel Tichenor has a very wide acquaintance in the automotive industry and his many friends will be glad to learn of his new connection.

For the Kellogg Company he will direct the entire production and manufacturing procedure.

New Milburn Paint Spray Gun Has Two Important Additions

These features are, first, a dialed head which gives numerous different spray adjustments from a circular spray to a fan of a wider field than has heretofore been possible with spray guns. The dialing permits the operator to obtain any desired spray instantly without first making tests.

Secondly, a series of indicator numerals on the paint valve plunger. A pointer is operated as the operator turns the adjustment button. Just as the dial in the head produces the exact spray wanted, so the indicator numerals on the paint valve plunger provide the exact volume desired without the necessity of losing time by testing. The operator having found that a certain class of work is best performed when the indicator points to a certain figure, makes the proper adjustment before beginning to spray.

To use a term made familiar by radio, the new improvements calibrate all operations and enable the operator to "tune in" instantly on the proper adjustment for perfect operation. They also substitute scientific accuracy for "rule of thumb."

The new Milburn Spray Gun is known as the Type EF. To enable owners of the Milburn Type E Gun to obtain the benefit of the improvements, the new dialed air control valve and the plunger have been made interchangeable and the Type E Can, therefore may be brought up-to-date by the insertion of these parts at the factory of The Alexander Milburn Company in Baltimore. In other words, in bringing out the Type EF Paint and Lacquer Spray Gun, the Type E Gun has not been made an "orphan."

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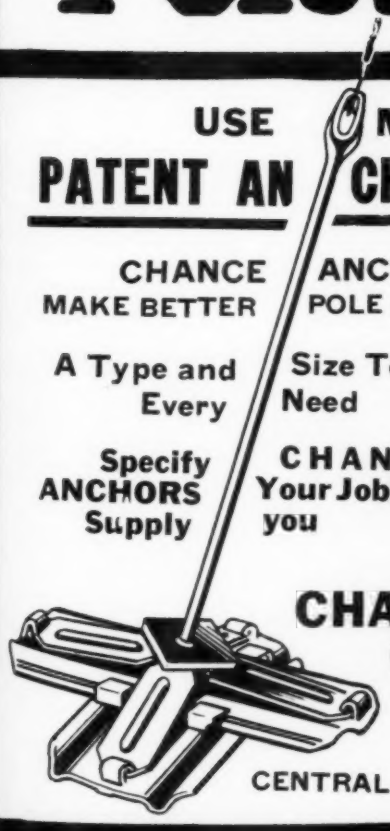

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New Wheeling - Pittsburgh Cable

By EDWIN F. HILL, in Transmitter

Wheeling will be the first city in West Virginia to be connected with leading cities, north, east, and west by a storm-defying telephone toll cable. A section of cable now being constructed between Wheeling and Pittsburgh—a distance of 57 miles—to be placed in service about June 1, will form a part of a New York-St. Louis cable and will cost about $700,000.

In addition to the cable it has been necessary to establish a new telephone repeater station in Wheeling. This apparatus and the building addition in which it is being housed involve an additional expenditure of $314,000.

One of the features of the equipment now being placed in the Wheeling central office is the aluminum finish, which, telephone engineers state, is superior to the black enamel formerly used on such apparatus. The aluminum finished equipment, they say, will be much easier to keep clean and will therefore give more satisfactory service.

Cambridge, Ohio, is the next point to which this toll cable will be extended. Cable crews are now engaged in stringing and splicing the cable between Wheeling and the Ohio city.

The Wheeling section of the cable will connect at Pittsburgh with an existing cable that extends east to Harrisburg, Philadelphia, New York, Boston and other New England points as far north as Portland.

The Wheeling-Pittsburgh cable has all been placed and the sections are now being spliced into a continuous length between the offices in the two cities.

This cable contains 264 telephone lines and six radio chain hook-up circuits. To provide this number of long distance circuits without the use of cable would require the construction of at least five open wire lines of about 60 wires each.

In selecting a route for the new cable, the telephone engineers laid out as nearly as possible a straight line between the two cities. The cable follows "up hill and down dale," regardless of natural obstructions. Where the line passes through heavy timber, a right of way has been cleared.

The cable will not replace the present open wire lines now being used between Wheeling and Pittsburgh, but to some extent the wire loads on these lines may be reduced. It is expected that open wire long distance lines will be used indefinitely in many sections, and that the cables and open wire lines will supplement each other.

Theodore N. Vail Medals Awarded

The Vail medal awards are made annually and are provided for by the Vail Memorial Fund established as a memorial to Theodore N. Vail, late president of the American Telephone and Telegraph Company.

Under the terms of the establishment, bronze, silver and gold medals are awarded to members of the Bell telephone organization throughout the United States, for acts or services which conspicuously illustrate Mr. Vail's ideals in public service.

The Vail medals are awarded for acts of heroism and reward for faithfulness in the performance of daily tasks.

Medals for 1927 have been announced as follows:

Gold Medal With Cash Award of $500

Fred F. Brown, foreman, plant department, The Connecticut Valley Telephone Company, Bradford, Vt.

Silver Medals With Cash Award of $250

William Foster Owens, manager, Rock Springs Telephone Company, Rock Springs, Texas.

Mrs. Clara B. Pitkin, agent, White River Valley Telephone Company, West Hartford, Vt.

Patrick B. McCormick, agent, New England Telephone and Telegraph Company, Becket, Mass.

Mrs. Mary E. Algor, agent, New Jersey Bell Telephone Company, Holmdel, N. J.

Horace E. Roby, superintendent of traffic, New England Telephone and Telegraph Company, Montpelier, Vt.

"The route for the new cable was laid out on as nearly a straight line as possible. The cable follows 'up hill and down dale, regardless of natural obstructions. Where the line passes through heavy timber, a right of way has been cleared."

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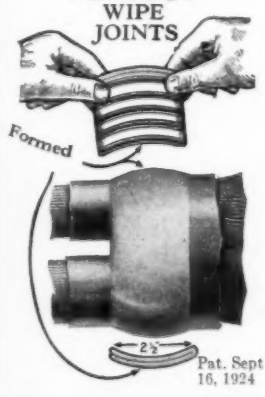

Pat. Sept 16, 1924

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Indiana Prefers Spring Meeting Good Attendance and Much Interest

Altering its custom of many years standing, the Indiana Telephone Association met in the spring rather than in the fall and the results were apparently satisfactory as the convention decided to meet again in May of 1929. The meeting of 1928 was held at Indianapolis on May 9, 10 and 11. Approximately 300 telephone managers and employees were in attendance to benefit from the interesting programs of the general sessions and the operators' meetings.

After a report by W. H. Beck, the recently elected Secretary-Manager of the association, which showed progress and financial stability, the convention was formally welcomed to Indianapolis by Dick Miller, president of the Indianapolis Chamber of Commerce. In responding to Mr. Miller's welcome, Frank E. Bohn, president of the Home Telephone and Telegraph Co. of Fort Wayne gave many interesting reasons why telephone men should think of themselves as being in one of the best businesses in the world. "The men and women in the industry are even more important than the plant, buildings and equipment," said Mr. Bohn.

Professor C. Francis Harding, head of the school of electrical engineering of Purdue University, then spoke of modern advances in the electrical art. He referred to many services which now may be given over electrical power and communication systems, among them being time service, program distribution, television and televox. In many of these services, high frequency currents are used and this brings many interesting and intricate technical problems.

The last speaker of the first session was R. V. Achatz of Aurora, Ind., who spoke on adequate rates. The speaker limited himself to a discussion of conditions in exchanges of from 100 to 300 stations and showed that many of the expenses were practically fixed. The real problem, he said, is to get a schedule of rates that will meet these expenses and yet not make the cost of service so great that development is restricted.

President F. B. MacKinnon of the United States Independent Telephone Association was the first speaker of the Thursday morning session. He called attention to the enormous development of world trade and of international communications since the world war and also to the effect of an accumulation of money in the United States which has resulted in many mergers in the telephone industry, some of which are not on a sound financial basis. He referred to one company with 30,000 stations having outstanding securities amounting to $200 per station which would be lower than the actual amount if service stations were omitted. Some men are happier working as individuals while others are happier when they function as a portion of a large organization. By preserving two groups in the telephone industry, opportunity for both individual and mass workers is preserved.

The annual address of President Henry A. Barnhart of the Indiana Association was, as usual, a thoughtful survey of conditions affecting the industry in Indiana. President Barnhart paid his respects to the financial adventures in the telephone field and said that the entire industry should join hands to prevent reckless investment which may cause a general calamity. In dealing with the public nothing is more dangerous than making people feel that the company is resorting to snap tactics. We must avoid the appearance of unfairness by taking the public into our confidence and telling them frankly of our needs and intentions. Mr. Barnhart paid a tribute to the late Charles S. Norton and showed how well his plan of district organization in association work is operating. He also spoke of the good fortune of the association in securing Mr. W. H. Beck as secretary-manager to take the place left vacant by the death of Mr. Norton.

Mr. L. W. Ridenour of Modoc was the next speaker. He presented an excellent discussion of "Service in the Small Exchange" and emphasized the necessity of co-operation. The small exchanges operated by men with a vision of service are a distinct stabilizing factor in the industry. The larger companies and the association can help the service of the small exchange by following up cases of poor service, offering assistance where it will be acceptable and using pressure where offers of help are declined.

Thursday afternoon the convention listened to a paper on "Co-operation between the State Highway Commission and Wire Using Companies" by A. H. Hinkle, Superintendent of Maintenance of the State Highway Commission. Mr. Hinkle spoke of the necessity of wider rights-of-way for highways and gave suggestions for making roadside plantings that would cause as little difficulties as possible between property owner, highway authorities and wire using companies. After Mr. Hinkle's paper, the general meeting was joined by the operators who had been holding a separate session and listened to an instructive talk on handling poor transmission complaints given by Dorothy H. VanErt, general traffic supervisor of the Illinois Telephone Association.

Thursday evening was given over to the annual banquet entertainment and dance. The Friday morning session was devoted to reports of the district associations and a discussion of rate matters by Max F. Hosea of Indianapolis. The retiring directors, Henry A. Barnhart of Rochester, Frank E. Bohn of Fort Wayne, Hart F. Farwell of Terre Haute, C. H. Rottger of Indianapolis and Sam Tomlinson of Plymouth were unanimously re-elected.

Ramblings

The Indiana convention proved the wisdom of the board of directors in naming W. H. Beck as secretary of that association, for he was certainly on the job all the time at the convention.

* * *

Like Maxwell House coffee, Jack Coffey is "good to the last drop." He surely makes you feel you are the "whole cheese" while in his home town.

* * *

J. Warren Safford, new president of the Ohio association, proves his interest in his job by attending the neighboring convention at Indianapolis. That's the spirit, Warren.

* * *

Our friend Welker was mixing with the crowd at the Indianapolis meeting; he is a regular fixture at conventions around Ohio and surrounding states.

* * *

J. K. Johnson, as secretary to the Independent Pioneer Telephone Association, evidently gets a great deal of pleasure out of work—and it is work indeed that he does too. We hope he is rewarded—here or hereafter.

* * *

Ed Shade certainly knows how to act as host to a lonesome fellow while in his home town of Johnstown. For the short space of time spent in his 'berg" we saw more and learned more of that historical city than one ordinarily learns in months.

* * *

And over at Harrisburg, we all know what to expect over there, for that's the home of H. E. Bradley, several ex-es and present president of the Pennsylvania association. "When you want information, ask Brad." That's the answer.

* * *

And when you reach Jamestown, N. Y., you are treated like a long lost brother, prodigal son, etc. The Wrights are right there when it comes to making a fellow feel at home. "When A Fellow

Needs A Friend" a trip to Jamestown will bring that renewed feeling which makes life worth living.

* * *

Dropping down to Bellevue, Ohio, we found Frank Knapp still struggling with the problems brought about by the snow storm of late spring, which did so much damage to properties in that section. Photographs of property damage in Bellevue is enough to discourage an ordinary fellow, but not so with Knapp. He is rebuilding as fast as possible and hopes to "dig out" in a few more weeks.

* * *

Continuing on down to Fort Wayne, Ind., we found the ideal city with the ideal telephone exchange. Nothing seems to have been left undone to make the surroundings of the Home Telephone & Telegraph Company all that the heart could wish for. We are not going to try to tell in this paragraph what we found in Fort Wayne, but the treatment accorded the writer by Messrs Bohn, Gray, Switzer and Mead was sufficient to cause us to always have a warm feeling in our heart for Fort Wayne.

* * *

Over at Logansport you always find a welcome awaiting you when Walter Uhl is at home. As one of the active workers in National Independent telephony Walter has always been found willing and anxious to carry his part of the load. It's a pleasure to count such men as Walter Uhl our friend.

* * *

And at Rochester, Ind., we found, as usual, Henry Barnhart at his desk. Working seems to be a pleasure with this veteran telephone man. Though hovering around three score and ten, he is as active as ever, and together with his very efficient staff, gives Rochester service unexcelled in much larger cities.

* * *

Yes sir, the writer saw many interesting places of historical interest the past month, for which he owes much to his friends along the route, who not only furnished excellent advice but assisted in other ways in making our visit a veritable vacation.

Gulf States Telephone Company to Have New Office Building

The Gulf States telephone company, with headquarters at Tyler, Texas, will have a new office building erected in that city, according to a statement of R. B. Still, general manager of the Gulf States telephone company. This company owns and operates some thirty exchanges in Texas.

Space has been planned on both sides and in front for flowers and lawn. The office will be used exclusively by the telephone company.

40,000 Oklahomans Are Stockholders in Oklahoma Utilities—O. D. Hall

From the publication, "Oklahoma," we publish a resume of an article by O. D. Hall, assistant manager of the Oklahoma Utilities Association, showing the phenomenal growth of public utilities in that state. He says in part:

"Oklahomans are acquiring annually a greater financial interest in the public utilities which are giving them electric light and power, natural gas, telephone and electric railway service. These utilities alone have more than 40,000 stockholders in Oklahoma, according to statistics compiled by the Oklahoma Utilities Association.

"Before the world war, little was heard of customer ownership of public utilities, but within the past ten years, the movement has grown rapidly in the nation, including Oklahoma, until stocks and bonds of these companies are found among all classes of citizens.

"The customer ownership movement thus has given new meaning to the word 'public' in the term public utilities. Some national utility leaders predict that within a few years, a majority of the stocks and securities of public utilities will be owned by customers.

"There are now in Oklahoma more than 650,000 customers of the major classes of utilities. Utility officials estimate that probably a million other Oklahomans, not listed as customers, come in daily personal contact with one or more kinds of public utility service. This estimate does not include the many hundreds of thousands who ride the railroads and inter-city motor busses, and patronize cotton gins and ice plants, also classed as public utilities.

"Within the short period of eight years, the electric transportation line mileage has increased in this state from approximately 500 to 5,700 miles. The gas transportation pipe line mileage has increased from a negligible figure to more than 5,000 miles. Approximately 500 towns now have electric service and more than 235 towns have gas distribution. The use of the telephone in the state has become almost universal. Telephone lines extend not only to most of the homes in every city and town, but to many thousands of farms.

"More than 12,000 executives and employes of electric light and power, natural gas, telephone and electric railway companies are engaged in giving public utility service in Oklahoma. Many of them own stock in these utilities, which gives them a vital interest in the welfare of the company and in preserving good service and maintaining friendly relations with the public.

"The total horsepower capacity of electric plants in Oklahoma at the end of 1927 was approximately 360,000.

"Marked activities were not confined to the electric light and power business. There was greater extension of natural gas service last year than in any previous year of Oklahoma's history. Several great gas transmission lines, ranging in size from 12 to 20 inches, were extended across portions of the state. Two big lines, crossing sections of northwestern and southwestern Oklahoma, were extended from Kansas and Texas, respectively, into the Texas Panhandle gas fields.

"Many Oklahoma towns were placed within reach of gas service by these lines. A 12-inch line was constructed from the Chickasha field to the South Canadian river, giving Oklahoma City two 12-inch lines to that field, in addition to other lines running in from the north.

"Much new capital was injected into the telephone industry during 1927. A budget of more than $6,000,000 was utilized by the Southwestern Bell Telephone Company for improvements in the state. Independent telephone companies of Oklahoma have expended large sums in improvements. A large amount of new capital was brought into the independent telephone field through mergers. Groups of financiers from outside the state combined their capital with several Oklahoma telephone leaders and purchased many small, independent telephone properties."

Elkhart, Ind., Exchange Under New Ownership

The Central States Telephone Company, with headquarters at Chicago, has bought the stock of the Home Telephone Company of Elkhart, Ind. It is stated that eighty-five per cent of the stock sold for $1,500,000 cash. The other fifteen per cent was already in the hands of the present owners.

To Prevent Long Conversation

New York Telephone Co. installing system to prevent long conversations on 5-cent toll. Light to signal expiration of five-minute period and again at eight minutes when operator will demand extra coin or disconnect. Designed to prevent tying up telephones in long conversations rather than to produce increased revenue.

Directors of the Illinois Bell Telephone Company approved the expenditure of $1,513,073 for new plant in Chicago and $1,164,073 for Illinois outside of Chicago. Total expenditures approved so far this year now amount to $13,199,646.

R. W. Wales with Celoron Company

The Celoron Company (division of the Diamond State Fibre Company), Bridgeport, Pa., in conjunction with the opening of its new laboratory, and the introduction to the electrical, radio and automotive fields of Celoron molding compounds, announces the appointment of Mr. R. W. Wales as factory representative on molding powders and resins. This announcement is made by Mr. T. E. Webster, vice president in charge of sales.

R. W. Wales

Mr. R. W. Wales enjoys a background of many years of experience in the developing and manufacture of molding compounds, having been connected with one of the largest manufacturers of this material for fifteen years.

His association with the Celeron Company should prove to be a forerunner of important announcements of interest to all molders.

Announcement

May we advise that the partnership lately existing between Ward H. Snook, A. S. Hillhouse and George Martin, under the firm name of Snook, Hillhouse & Company, Consulting Engineers, 40 West Gay Street, Columbus, Ohio, was dissolved on the 31st day of May, 1928, by mutual consent.

We will continue in business at the above location under the name of Snook, Martin & Company, Consulting Engineers & Attorneys.

In view of the fact that all technical and legal work has been handled by Mr. Snook and Mr. Martin, we will have all records, plans, maps, appraisals and other studies, as well as work in progress, available to our clients at this office, and we will be pleased to cooperate with you and Mr. Hillhouse in making use of such records.

We trust that the same friendly relations with all our friends and clients, which it has been our privilege to enjoy in the past, will continue in the future. Yours, as always, for more and better service.

WARD H. SNOOK, M.E., L.L.B.
GEORGE MARTIN, M.E., E.E.

RECONSTRUCTED EQUIPMENT

Western Elec. No. 250 or 229 type Transmitters complete @	$ 1.15
Western Elec. No. 329 type Transmitters complete @	1.40
Western Elec. No. 122 external post Receivers with cord @ $1.00—No. 143 type @	1.40
Magnet Charger for recharging Generator, ringer & Rec. magnets, works off 6-volt Ford Auto Batt. @	8.00
Dean Elec. or Garford C. B. Steel hotel sets equipped with balance coil talking Ckt. and Straight line or 16-33-50 or 66 cycle harmonic ringers @	5.00
Western Electric Co. No. 533 Common Batt. steel hotel sets with enclosed gongs, Straight line @	7.50
Kellogg or Western Elec. No. 13 Local Batt. Ind. coils @	.35
Western Elec. No. 20 Common Battery Ind. coils @	.35
Kellogg No. 2696 type 3-bar 1000 or 1600 ohm Bdg. compacts @ $7.75—4-bar @	8.50
No. 19 single conductor inside telephone wire, per 1000 feet @	3.75
4-foot 3-conductor New desk set cords, brown finish @	.15
Stromberg No. 14 or Dean Elec. Receivers complete with cords @	1.10
Kellogg 16-33-50 or 66 cycle harmonic ringers @	1.25
Kellogg No. 28 3-bar 1000 or 1600 ohm Bdg. desk set with external post signal cases @ $9.50—with concealed cord and line signal set @	10.00

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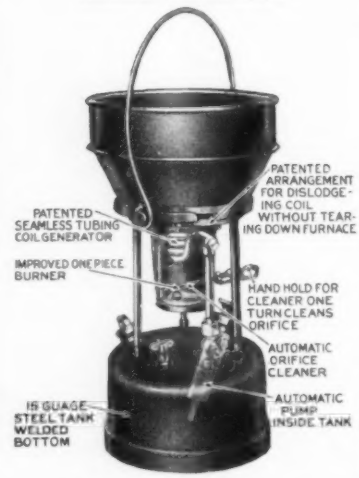
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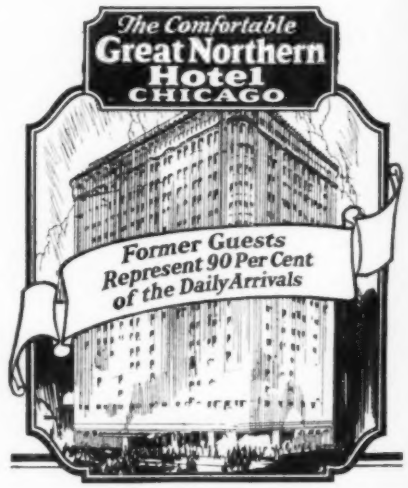

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Creosoted Pine Pole Line Spans Skokie Marshes

The Public Service Company of Northern Illinois, in meeting the continually increasing demands for electrical service in the territory suburban to the City of Chicago, sometimes encounters unusual problems in construction of its overhead lines. Such a problem existed in the installation of a new power line west of Glencoe, Ill., and extending through a section of swamp land known as Skokie Marshes. These marshes consist of a series of low-lying flats, poorly drained, and subject to periodical overflow. During the summer months the surface water disappears for considerable periods, but the ground never becomes dry and hard, which condition not only made the setting of a pole line difficult, but created an ideal situation for the formation and propagation of decay-producing fungi. Also, during the summer and fall grass fires are prevalent in this locality. The type of pole required, therefore, was one that could successfully resist decay and at the same time be fire-resistant. After a careful investigation of the situation pressure-creosoted pine poles were decided upon as the type best suited to meet all the requirements.

This line extends from the foot of South Avenue, Glencoe, near the western limits of the Skokie Country Club, for a distance of a mile westward toward the village of Northmoor. The general unstable condition of the ground combined with occasional high winds necessitated a type of overhead construction somewhat out of the ordinary for service of this kind. An "H"-frame standard was installed, consisting of two 30-ft. poles, spaced on 6-ft. centers, connected near the top by a 3¾-in. by 4¾-in. by 8-ft. horizontal cross-arm, and further stiffened and strengthened by diagonal braces, extending from the mid-point of the cross-arm to each pole and secured in place by bolts. These frames are spaced on 125-ft. centers, and every third unit and all corner units are guyed and cross-guyed.

The poles support and carry a 4-conductor, 350,000-circular-mill, 5,000-volt lead-covered cable. The present cable is strung along the north side of the standards, and when the demands of this rapidly growing section require additional power it is planned to place similar cables along the south side and if necessary along the axis of the line.

These pine poles are 30 ft. in length with a top diameter of from 7 in. to 8 in., natural taper to the butt, and treated with coal-tar creosote by a standard empty-cell process with a final retention of 8 lbs. per cu. ft. of timber. The use of pressure-creosoted poles in this line and the great care exercised to overcome the difficult setting conditions assure maximum service at a minimum cost.

An interesting detail of this project was the method employed in setting the poles. Instead of excavating the holes in the usual manner, the poles were first raised and held by guys in a vertical position in the exact location in which they were to be set, and dynamite placed in the ground at a depth equal to the desired elevation of the butt end of the pole when set. The dynamite was then exploded, the pole settled into correct position, and the ground tamped into place. This procedure is particularly effective in soft ground and is far more economical than setting the poles by hand labor alone.

Texas Creosoted Pine Poles Serving in Skokie Marshes under Severe Conditions

UP-STATE TELEPHONE ASSOCIATION HOLDS THREE-DAY BUSINESS SESSION AT ROCHESTER

(Continued from page 29.)

The outstanding work of the convention was the romping on promoters who buy telephone properties for the purpose of exploiting them. Strong resolutions condemning this practice were adopted after instances were shown where prices were offered almost double that of the actual worth of the property. To the credit of those interested in the industry, it must be said that such offers were refused. The president's address showed very few properties changing hands in New York state during the past year.

Other subjects were discussed in the usual able way of those who attend the Up-State convention. Chas. C. Deering for the United States Independent Telephone Association told of the work of his association.

A golf tournament and banquet were social features of the convention.

The following directors were re-elected:

John P. Boylan, president of the Rochester Telephone Corp.; John H. Wright, of Jamestown; H. P. McDonough, of Newark; G. G. W. Green of Johnstown; F. C. Saunders, of Wellsville; W. A. Seely, of Norwich; F. D. Fancher, of Middletown; J. G. Ihmsen, of Albany; H. W. Fluhrer, of Oneonta; L. H. Jenks, of Carthage, and B. H. Brooks, of Plattsburg.

H. H. Griswold was elected as a director and vice-president, when a new district was created.

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Convention Calendar

Indiana.

Northern Indiana District, Lake Wawasee, Ind., June 19-20-21, 1928.

Vermont.

Vermont Telephone Association, Burlington, Vt., June 21st and 22nd.

Washington.

Washington Telephone Association, North Bend, Wash., June 22nd and 23rd.

Pennsylvania.

Tri-State Telephone convention, Erie, Pa., August 8-9-10, 1928.

Harry Vail Now Manager at Weston, Mo.

Harry Vail, the ambitious employe of the Midwest Telephone Co., operating in Missouri, has been transferred to Weston from St. Joseph. He asked for this transfer so that there would be a greater field of development. Having experience as lineman, trouble-shooter and other branches of the trade, Vail should have no trouble in handling his new job as manager.

Two Radio Companies Merged in Illinois

Official announcement is made of the consolidation of two nationally known manufacturers of radio. The consolidation has been accomplished through a merger of the All-American Radio Corporation and the Mohawk Corporation of Illinois, both of Chicago. The two companies are licensees of the Radio Corporation of America, Westinghouse Electric Manufacturing Company, General Electric Company and the American Telegraph and Telephone Company. In addition the Mohawk Corporation holds several valuable patents.

There has been an increase of more than 100 per cent in the number of telephones in Chattanooga, Tenn., in ten years.

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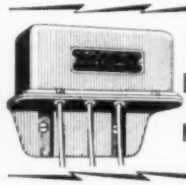

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COLUMBUS, OHIO

BUZZER AND TONE TEST FOR TROUBLE LOCATION

The following letter of inquiry was referred to Mr. E. R. Collins, whose reply is given below.

"In the March 1928 issue of TELEPHONE ENGINEER is the article on 'Studying Telephone Methods' you showed a plan of a buzzer and tone test, Fig. 111, Page 28. I will be very much obliged if you will explain how it is operated, also will this apparatus act in connection with an exploring coil to locate trouble."

"You will have to be very explicit as I am only a rural phone lineman and have not taken the subject up very thoroughly."

Your inquiry addressed to TELEPHONE ENGINEER relative to the buzzer and tone set described in Fig. 111, Page 28, of the March issue, has been referred to me for a reply.

If you will refer to Fig. 111 and trace out the circuit, commencing at the top terminal marked flexible cord, you will find the following circuit: from flexible terminal, to top terminal of buzzer, through the buzzer coils, through armature contacts and battery, middle springs of key to the bottom flexible cord.

This is an ordinary buzzer circuit. If the two flexible terminals are connected, the buzzer will operate. The use of a buzzer in this form is to locate the two ends of a wire. Suppose you had, say, six wires in a bunch and you wanted to find the two ends of one of the wires. Then you would connect the buzzer to the one end of the wire wanted, and then by touching the other flexible cord of the buzzer to the other wires in turn, the other end would be found when the buzzer operated. Now, if you connected this buzzer in the above position to the primary terminals of the induction coil in Fig. 112, the buzzer would likely operate because the resistance of the primary is very low. But you would not be able to make the buzzer operate through the secondary winding of the induction because the resistance of this winding would be too high.

When the 272 key is operated, trace a circuit from the battery through the left hand, make contacts of the key, to the upper side of the buzzer coil, through the coils and the armature and contacts back to battery. Therefore when this key is operated, the buzzer will buzz continuously.

The make and break of the battery through the buzzer coils will cause a rise and fall of the magnetic field, and will induce currents into the buzzer coils. This rise and fall of the induced currents will charge and discharge the condenser bridged across the coils. The condenser discharge will increase the pull of the battery because its flow will be in the same direction as the battery flow. Thus the condenser will pep up the action of the buzzer. The resulting voltage with the condenser will be much higher than without it. You can trace a circuit from the upper flexible through the condenser and the buzzer coils in parallel, through the 50 ohm non-inductive resistance, through the right hand make contact of the key and out the lower flexible terminal.

If the 50 ohm resistance were not in place and the two flexible terminals were connected together, there would be a short circuit across the buzzer coils, and as this would be lower in resistance than the coils the greatest amount of the current flow would be through the short circuit instead of the B buzzer coils. The 50 ohm coil should not have any iron in it, as this would have a tendency to retard the flow of the induced current from the buzzer and the condenser in parallel. This current will be alternating, and of a fairly high frequency.

Now for the use of this tone. It can be used in connection with the exploring coil shown in Fig. 110, or in connection with the exploring coil used by cablemen for locating cable trouble. It is also very useful for use as a direction finder, as will be described in the May issue of TELEPHONE ENGINEER.

In Fig. 104 and 105 the general use of a tone is described, and the source of the tone for this purpose is best in the form shown in Fig. 111.

Just bear in mind that the output of the tone set when the key is operated will be alternating current. Therefore any style of an exploring coil can be used as shown in Figs. 104, 105 and 108, and again in 112.

I trust I have been able to make the difficulty clear to you. The only way to find out these things is to ask questions, if you can't find the answer in any other way. There is always a great possibility for the man who will ask questions. If I have not answered this to your satisfaction, please come again, but be explicit in your questions.

New Haven, Ind., Is Automatic

Fort Wayne, Ind.—Announcement recently was made by Mr. Frank E. Bohn, President and General Manager of The Home Telephone and Telegraph Company of Fort Wayne, Indiana, that the New Haven exchange, owned by that company, now operated under the manual system, will be converted into the automatic or dial system, effective December 1, 1928.

The order for the automatic equipment has been placed with the Automatic Electric Company of Chicago. The entire cost of the equipment, outside rehabilitation and other rearrangements which will be necessary will be approximately $60,000.

The installation will start with 200 lines with a capacity for 500. A distribution system and additional circuits to Fort Wayne to care for the maintenance and operation of the automatic lines will be installed. Exchange boundaries and standing toll charges will remain the same.

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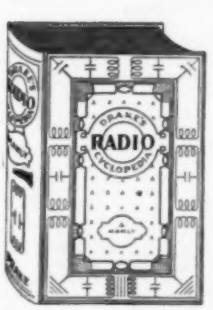

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